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Tyco Fire Products LP Facility, Marinette, Wisconsin

Five Year Technical Review

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Acronyms and Abbreviations

µg/L	micrograms per liter
AOC	Administrative Order on Consent
bgs	below ground surface
BWGMPU	*Barrier Wall Groundwater Monitoring Plan Update*
CH2M	CH2M HILL, Inc.
CIP	cure-in-place
CMS	corrective measures study
CoV	coefficient of variation
DCB	dichlorobenzene
DCE	dichloroethene
DGT	diffusive gradient in thin-film
DTW	depth to water
ES	enforcement standard
FB	field blank
ft/day	feet per day
gpm	gallons per minute
GWCTS	groundwater collection and treatment system
IGLD	International Great Lakes Datum
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
mg/yr	milligrams per year
O&M	operations and maintenance
PAL	preventative action limit
PDP	Pump Down Program
PRB	permeable reactive barrier
psig	pounds per square inch gauge
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
SCM	semi-consolidated materials
site	Tyco Fire Products LP facility located at One Stanton Street, Marinette, Wisconsin
Tyco	Tyco Fire Products LP
URS	URS Corporation
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
VOC	volatile organic compound

VSEP	Vibratory Shear Enhanced Processing
WDNR	Wisconsin Department of Natural Resources
WPDES	Wisconsin Pollutant Discharge and Elimination System

1. Introduction

This five-year technical review report is provided pursuant to the Administrative Order on Consent (AOC) between Tyco Fire Products LP (Tyco), located at One Stanton Street, Marinette, Wisconsin, and the U.S. Environmental Protection Agency (USEPA), dated February 26, 2009, and has been prepared in accordance with Section VI, 11, paragraph g of the AOC (USEPA 2009a). For this document, the term site is used to refer to areas associated with the AOC, including the terrestrial property and adjacent areas within the Menominee River. The AOC required Tyco to submit the initial five-year technical review report to USEPA by December 31, 2013 and to provide additional reviews every 5 years thereafter. This is the second five-year technical review report for the site.

The AOC also requires monitoring to be conducted to evaluate the effectiveness of the groundwater management system to contain arsenic-impacted groundwater within the containment areas. As part of that requirement, a report is to be submitted annually documenting the monitoring effort. Based on discussions with USEPA, the 2018 barrier wall groundwater monitoring annual report components have been incorporated into the five-year technical review, streamlining the submittal and review process for these documents. Because of the timing of preparing and submitting this combined report, this report includes data/information collected through early November 2018.

1.1 Document Organization

This report is organized into the following sections:

- **Section 1, Introduction**—Provides the site description and brief history, physical site characteristics, components of the selected remedy for the site, and the document organization.
- **Section 2, 2018 Barrier Wall Monitoring Activities**—Provides a summary of the barrier wall groundwater monitoring activities completed in 2018.
- **Section 3, 2018 Barrier Wall Effectiveness Evaluation**—Provides a summary of the groundwater system operations and the evaluations of the barrier monitoring data and applicable supplemental monitoring data collected from January 2018 through early November 2018.
- **Section 4, Status of the Remedy**—Describes the components of the selected remedy listed above, including the *Agreement on Resolution of 2013 Five-Year Technical Review Issues* (AOR; USEPA 2014a) and other remedy enhancements, and presents the status for each component. This section also incorporates the onsite groundwater management component review, evaluates the performance of the three main technologies from the AOC that make up the groundwater management component, and discusses their appropriateness and any proposed modifications.
- **Section 5, Review of Arsenic and the Protection of Human Health and the Environment Related to Groundwater**—Provides an evaluation of the current scientific and engineering knowledge relevant to protecting human health and the environment.
- **Section 6, Review of Arsenic Treatment Technologies Related to Groundwater**— Review of treatment technologies for remediating arsenic in groundwater that have been developed since the 2013 five-year review.
- **Section 7, Summary of Conclusions**—Summarizes the conclusions from the review and presents any potential future activities under consideration.
- **Section 8, References**—Provides the references cited in this report.

1.2 Site Description and History

The site is an active manufacturing facility in northeastern Wisconsin, adjacent to the southern shore of the Menominee River (Figure 1). The facility property is bordered by the Menominee River to the north; the 6th Street Slip and City of Marinette property to the east; Water Street, City of Marinette property, Marinette School District property, and residential properties to the south; and Stanton Street and Fincantieri Marinette Marine to the west.

The facility consists of approximately 63 acres, including a manufacturing area on the western part of the property and an undeveloped area to the east, commonly known as the Wetlands Area. The Salt Vault and 8th Street Slip areas are located between the manufacturing and Wetlands Area. A fence surrounds the facility and access is restricted. Figure 2 shows the facility site plan.

The facility was first used for lumber mill operations, sawdust disposal, and raw and cut lumber storage. Tyco (or its predecessor companies), which has occupied the property since 1915, manufactured cattle feed, refrigerants, and specialty chemicals. The facility manufactured arsenical-based agricultural herbicides from 1957 to 1977. A byproduct of the manufacturing of this herbicide was a salt that contained approximately 2% arsenic by weight and was stockpiled at several locations on the property and subsequently entered site soil and groundwater. By 1978, the facility ceased production of arsenical-based herbicides and, since 1983, has produced only fire extinguishers and fire suppression systems.

The site and associated impacts have been studied since 1974. Tyco has implemented several corrective measures under State of Wisconsin remedial action programs and the U.S. Resource Conservation and Recovery Act (RCRA) program. Between 1999 and 2000, interim site corrective actions were completed including constructing a slurry wall and/or sheet pile sections around the Salt Vault and 8th Street Slip (Figure 2) to contain groundwater (the Salt Vault and 8th Street Slip are now enclosed/contained and no longer used for their original purposes; therefore, they are referred to as the former Salt Vault and the former 8th Street Slip). An interim corrective action also was conducted in the former 8th Street Slip. Soft sediments in the 8th Street Slip were removed, the slip was filled and covered with asphalt, and a groundwater monitoring program was established. Based on the results of the monitoring program, USEPA agreed that monitoring could be discontinued within these containment areas because the effectiveness of the barriers had been established. The 2009 AOC documented corrective actions required at the site (USEPA 2009a). Details regarding these remedial actions are presented in Sections 1.5 and 4.

1.3 Physical Site Characteristics

Site geology on the upland side consists of an upper soil layer consisting of sand/gravel fill. Based on historical documentation, the fill material has been placed on the site periodically for over 100 years of various operations. Beneath the fill layer is a loose to medium dense alluvial deposits consisting of fine- to coarse-grained sand and gravel. Some of these alluvial deposits consist of an organic-rich fine-grained peat material. Underlying the alluvial stratigraphy is a layer of dense silty sand to sandy silt that transitions to an even denser sandy silt and clay compacted glacial till deposit. Below this is dolomitic bedrock approximately at 40 feet below ground surface (bgs). In the near-shore environment, there are also four distinct material types: soft sediment, semi-consolidated materials (SCM, fine- to medium-grained sands, analogous to the alluvial deposits in the upland area), glacial till, and dolomitic bedrock. Before the 2012-2014 removal actions, water depth in the river in the project area ranged from less than 1 foot in the South Channel and 26 feet in the Main Channel of the Menominee River.

Regional groundwater flow beneath the facility is generally northeast toward the Menominee River. Noted variations in historical groundwater flow (before construction of the barrier wall) were observed in the northwestern portion of the facility: groundwater flow was from the southeast toward the northwest, likely the result of a filled-in slip that is present along the western border of the site. Other local preferential pathways of migration may be present at the site. The direction of groundwater flow is affected near the facility because of the presence of the containment barrier wall, which was completed in fall 2010. Regional groundwater flow outside the facility likely remains generally toward the Menominee River but is diverted around the barrier wall directly south of the facility.

1.4 2018 Barrier Wall Groundwater Monitoring

This report serves as the annual report for 2018 and summarizes the monitoring and field activities, associated data, and a quality review of the laboratory data collected for the January 2018 to early

November 2018 monitoring period. This report also assesses the effectiveness of the current monitoring wells, evaluates the available data, and evaluates the effectiveness of the containment barrier wall in accordance with the *Revised Barrier Wall Groundwater Monitoring Plan Update* (BWGMPU; CH2M HILL, Inc. [CH2M] 2015a) approved by USEPA on September 15, 2015 (USEPA 2015a).

1.5 Selected Remedy

The 2009 AOC required the implementation of remedial actions at the site. The primary components of the selected remedy include:

- Institutional Controls
- Soil Remediation, which includes limit soil excavation and installation of covers
- Site Security
- Menominee River Sediment Removal
- Onsite Groundwater Management, which includes the containment barrier wall, engineered groundwater collection and treatment system (GWCTS), phyto-pumping system, and barrier monitoring

Pursuant to the AOC, all primary components of the remedy were implemented between 2009 and 2013. The components of the selected remedy and their status are described in greater detail in Section 4, including any operations and maintenance (O&M) requirements (per agency-approved plans).

Quarterly reports are submitted to the agency, as required in the AOC, to document the activities conducted as part of the corrective actions and each report presents a brief description of the work completed during the reporting period, data collected, problems encountered, schedule of planned activities, as well as key correspondence and documents submitted for the quarter. Additional information was communicated in weekly/biweekly summary reports emailed to the agency during active construction of the remedies. A summary of AOC required deliverables submitted from December 2013 through early November 2018 is presented in Table 1. The components of the AOC tasks and their status are described in greater detail in Section 4.

After completing the 2013 five-year review and the decision to move forward with the Legacy Act Project (which accelerated the remediation of contaminated sediments) in coordination with the Great Lakes Legacy Act group within USEPA, an AOR was entered into between Tyco and USEPA (USEPA 2014a). The AOR required implementing the following tasks:

- Pump down program (PDP) to lower groundwater levels in the former Salt Vault and 8th Street Slip to an elevation at or below the U.S. Army Corps of Engineers (USACE) ordinary low water mark datum elevation of 577.5 feet (International Great Lakes Datum [IGLD] 1985) and maintain the target elevation in perpetuity
- Estimate seepage at the Main Plant barrier wall
- Sediment sampling in 2018 and 2023
- Main Plant barrier wall dye testing
- Update the *Barrier Wall Groundwater Monitoring Plan*
- Submit an addendum to 2013 five-year review addressing USEPA comments

An additional task was added during the review of the BWGMPU (CH2M 2015a). USEPA's letter *Comments and Request for Revision* dated October 10, 2014 to Tyco (USEPA 2014b), requested that an outfall investigation plan be developed to determine whether arsenic in the shallow groundwater is finding its way into the stormwater conveyance system and is being conveyed to the Menominee River through the outfalls, with the goal of protecting the river from arsenic re-deposition subsequent to the river sediment remediation effort. Tyco agreed the investigation was needed to obtain information on the sewers and develop a path forward based on sampling results. All components of the AOR remedies have been initiated, are in progress, or have been implemented. The components of the AOR tasks and their status are described in greater detail in Section 4.

2. 2018 Barrier Wall Monitoring Activities

Barrier wall monitoring activities completed by Tyco in 2018 were conducted in accordance with the 2015 BWGMPU (CH2M 2015a) and included:

- Collecting semiannual groundwater elevation data
- Conducting semiannual groundwater sampling for analysis of total arsenic
- Conducting five-year groundwater sampling for analysis of volatile organic compounds (VOCs)
- Performing semiannual well network inspections
- Resurveying a portion of the well network
- Surveying and inspecting the sheet pile barrier wall

The following subsections summarize the monitoring activities completed in 2018. Monitoring locations are shown on Figure 2, and information on the status and frequency of current data collection activities associated with each monitoring well is summarized in Table 2.

2.1 Groundwater Monitoring

2.1.1 Groundwater Elevations

Semiannual manual depth-to-water (DTW) measurements were taken in April and September 2018 at the wells indicated on Figure 2. If groundwater sampling was completed as part of a monitoring effort, a synoptic water level survey was performed before initiating purging or sampling activities. DTW measurements were recorded to the nearest 0.01 foot from the top of the polyvinyl chloride casing or riser pipe using an electronic water level meter. Transducers, at locations required in the BWGMPU with subsequent approved modifications, were installed in 2016 and data were downloaded quarterly. Pumping conditions around the April and September 2018 events included the following, with additional details on the GWCTS provided in Sections 3.1.1 and 4.5.3 (Table 3 includes average monthly flow rates):

Monthly Average Extraction Well Flow Rates (gallons per minute)							
Month	**EW-1**	**EW-2**	**EW-3**	**EW-4**	**EW-5**	**EW-6**	**EW-7**
April 2018	0.58	0.00	0.03	0.03	2.30	1.18	0.57
September 2018	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Consistent with the 2016 and 2017 PDP efforts, groundwater extraction occurred in the former Salt Vault and former 8th Street Slip during operation of the PDP from late April to early November 2018; extraction wells EW-2 and EW-3 were not operated during pump down activities. Extraction wells EW-1 and EW-4 are located within existing phyto-pumping plots, resulting in essentially dry conditions in each well during much of the growing season; therefore, limited groundwater was extracted at these locations during the 2018 growing season. In September 2018, mechanical issues at the GWCTS resulted in no pumping within the Main Plant and Wetlands Area for an extended period. Table 4 summarizes the manual DTW measurements collected during the 2018 events, and Appendix A includes the manual water level measurements collected between 2009 and 2018.

2.1.2 Equivalent Freshwater Head Corrections

High total dissolved solids occur within groundwater at select locations across the facility (that is, the salinity of groundwater across the facility is highly variable). Salinity affects the specific gravity of groundwater and ultimately the height of the water column measured within each standpipe piezometer and monitoring well; therefore, hydraulic head data for the facility have been corrected for equivalent freshwater head (CH2M 2015b). The corrected groundwater elevations are listed in Table 4, and Appendix A contains the correction factor for each well.

2.1.3 Continuous Hydraulic Head Measurements

Transducers have been installed in 21 monitoring wells and at the staff gauge location at the site in the Menominee River (SG4) to provide continuous monitoring of water levels at the site in accordance with the BWGMPU[1], and a BaroTROLL for monitoring atmospheric pressure changes is installed at a single well location (MW103M) within the site. In addition, a transducer is installed in monitoring well MW002S, located in the former Salt Vault, for continuous monitoring of water levels during pump down operations. In accordance with an agency-approved request, data at each pressure transducer are recorded hourly at each location and downloaded quarterly to assess whether groundwater within the barrier wall is acting independently of the groundwater and surface water outside the barrier wall.

2.1.4 Groundwater Sampling

Semiannual groundwater sampling activities were performed between May 2 and May 8, 2018 and between September 12 and September 17, 2018 at the monitoring well locations indicated on Figure 2. Groundwater purging and sampling were conducted in accordance with the *Quality Assurance Project Plan* (QAPP; Earth Tech, Inc. 2006) and applicable QAPP addendums (CH2M 2010a, 2012a, 2012b, 2013a). In accordance with Section 4 of the QAPP, monitoring well purging and sampling were performed using low-flow sampling techniques (USEPA 2002) to minimize turbidity and collect samples representative of formation conditions.

Groundwater samples were collected from the BWGMPU-specified wells and submitted to TestAmerica in University Park, Illinois (Wisconsin-certified) under chain-of-custody protocol as described within the QAPP (Earth Tech, Inc. 2006) and applicable QAPP addendums (CH2M 2010a, 2012a, 2012b, 2013a). Groundwater samples were analyzed for total arsenic using USEPA Method 200.7. In addition, consistent with the requirement of the BWGMPU, VOCs were analyzed for at select well locations using USEPA Method 8260B.

2.1.4.1 Data Usability

Analytical data collected were validated using the criteria of precision, accuracy, representativeness, comparability, and completeness defined in the QAPP (Earth Tech, Inc. 2006). Quality control criteria were evaluated for all samples as appropriate for each analytical method. These criteria include laboratory blanks, field blanks (FBs), field duplicates, laboratory duplicates, matrix spikes and matrix spike duplicates, holding times, and sample preservation.

The data quality evaluation memorandums and laboratory analytical data reports for April-May and September 2018 are included in Appendix B. No analytical data collected during this reporting period were rejected, resulting in 100% usable data as qualified during the data quality review process. The following represents a summary of the data quality review findings for this reporting period:

- For the sampling events, holding times were met, the chains-of-custody were free of errors, and all initial instrument calibration were within criteria.
- VOC samples collected during the April-May 2018 sampling event were preserved with hydrochloric acid upon sample collection. The pH for the sample set were checked on May 17, 2018 and two samples (MW045M and MW041M) were found to have a pH of greater than 2. The data were "J" qualified as estimated values, indicating a possible biased low result.
- Continuing calibration verification recoveries above criteria were reported during the September 26 and September 28, 2018 analysis. However; arsenic was reported as not detected in all associated samples; therefore, data qualification was not required.
- Arsenic was reported in one continuing calibration blank associated with the April-May 2018 sampling event and two continuing calibrations blanks associated with the September 2018 sampling event detected arsenic concentrations above the method detection limit. Associated sample results less

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[1] The transducers installed in monitoring wells MW040S, MW105S, and MW105D were relocated to monitoring wells MW003S, MW106S, and MW106D in July 2017 following receipt of approval from USEPA on June 5, 2017.

than 10 times the blank concentration were "JB" qualified, indicating concentrations reported are considered estimates.

- Two FBs were collected during April-May 2018 sampling event with arsenic reported above the reporting limit in the field blank (FB#1) collected on May 3, 2018. Associated sample results less than 10 times the blank concentration were "JB" qualified, indicating concentrations reported are considered estimates, Three FBs were collected during the September 2018 sampling event, with arsenic reported as not detected for all.
- All precision criteria were met for all analyses completed for the April-May 2018 sampling event and for most of the analyses completed for the September 2018 sampling event.

2.2 Monitoring Network Effectiveness

The monitoring network effectiveness is assessed by visually inspecting and documenting the condition of site wells during routine sampling events prescribed by the BWGMPU (CH2M 2015a). During the May 2018 sampling event, a visual survey of the condition of the monitoring wells was completed, and the following issues were identified:

- Monitoring well nest MW105, located near the southwestern corner of the Main Plant area and inside the barrier wall, was observed to have water to the top of the casing during the sampling event; therefore, no samples were collected from the medium depth and bedrock wells. Increased water elevations at these locations may be attributable to a water main break in the area and/or surface water runoff infiltration. Subsequently, extensions and protective pipes were installed at each well in monitoring well nest MW105 in August 2018.
- Monitoring well nest MW040, also located in the southwestern corner of the site, was observed to have cracking of the concrete flush-mount pad allowing water to infiltrate the flush-mount covers. The flush-mount pads and well covers in the monitoring well nest MW040 were replaced in August 2018.
- Monitoring well MW118D appeared to have a frozen water column in the well, resulting in no sample being collected at this location. In June 2018, MW118 was determined to have an apparent casing offset and was properly abandoned in early September 2018. Plans are being made to replace MW118D in 2019.

The condition of the remaining monitoring wells was determined acceptable for use; therefore, no other repairs were necessary. Table 2 summarizes the well and staff gauge status.

2.2.1 Monitoring Well Surveys

Elevations of select barrier wall groundwater monitoring locations were surveyed by a Wisconsin-licensed surveyor in December 2018. This resurveying was necessitated by the well casing extensions that were installed at each well of the MW105 monitoring well nest and repairs made to the flush-mount covers and wells casings at each well of the MW040 monitoring well nest. The most current survey data are included as part of the water level data provided in Appendix A.

2.3 Outfall Investigation Stormwater Sampling and Upgrades

Tyco implemented numerous upgrades/modifications to the existing stormwater management system in 2016 and 2017 to reduce the potential for arsenic-impacted groundwater to enter these systems and ultimately be discharged to the Menominee River. Details of the upgrades/modifications are presented in Section 4.11.

In 2018, Tyco completed the remaining components of the planned upgrade/modifications that included:

- Cure-In-Place (CIP) lining of stormwater roof drains at Building 29 (southwestern portion of the site). These roof drains are connected to subsurface stormwater lines that previously were lined in 2017. The activities were completed the week of October 15, 2018.

- Installation of a gate valve at the surface stormwater outfall (Outfall #6) associated with the former Salt Vault. The gate valve was installed on May 17, 2018. The subsurface outfall piping associated with this outfall had been abandoned, and the stormwater management for the area was converted to an above-grade conveyance structure in 2017. The gate valve is necessary to allow for separation of stormwater collected on the former Salt Vault that may come in contact with impacted soils or groundwater during potential future remedial actions that may occur in the area. The gate valve will remain open at all times unless remedial actions require temporary closure.

With the stormwater line upgrades/modifications completed, follow-up sampling was completed as summarized in the following subsections.

2.3.1 2018 Stormwater Sampling Event

The last of three planned stormwater system sampling events occurred on October 15, 2018. Samples were collected from 5 of the original 11 stormwater manhole or catch basin locations. Samples were not collected at the other six locations because five of the locations had been abandoned as part of the upgrade/modification work and one location (CB231) was associated with the Building 29 stormwater line. For this document, work near CB231 had not been completed at the time of sampling and appropriate weather conditions (that met sampling requirements) following the line modifications had not occurred in time for including subsequent sample collection and laboratory analysis data.

The analytical results are presented on Figure 3. The arsenic concentrations in the five samples ranged from 54 micrograms per liter (µg/L) in the stormwater sample collected at CB043 (permitted industrial line discharge Wisconsin Pollutant Discharge Elimination System [WPDES] Outfall #001) to 110 µg/L in the stormwater sample collected from manhole MH318, located south of Building 40 at the site.

2.3.2 2017 and 2018 Surface Water Sampling

On May 10, 2018, Tyco collected the final round of planned surface water sampling in the Menominee River. The surface water sampling was requested by the agencies in a March 21, 2016 document (USEPA 2016a) providing comments to the *Outfall Arsenic Investigation Technical Memorandum* (CH2M 2015c). The primary focus of the surface water sampling activities was to provide information for use in issuing discharge permits for the facility. Sampling included collecting surface water samples from upstream and three surface water samples downstream of the site. In addition, water samples were collected at the City of Marinette and City of Menominee drinking water intakes.

Four sampling events were conducted commencing in June 2017 (one event per quarter). The samples were tested for total arsenic concentrations. Table 5 provides the analytical results for each sampling event. Total arsenic concentrations in samples collected from the upstream location ranged from an estimated 0.75 to 1.1 µg/L. Total arsenic concentrations in the samples collected from downstream of the site ranged from an estimated 0.81 to 1.2 µg/L. Arsenic concentrations in samples collected from the drinking water intakes ranged from an estimated 0.71 to 1.2 µg/L.

3. 2018 Barrier Wall Effectiveness Evaluation and Conclusions

The following subsections summarize the groundwater system operations and evaluations of the barrier monitoring data and applicable supplemental monitoring data collected from January 2018 through early November 2018, as well as the conclusions from the evaluation. The barrier wall's effectiveness continues to be assessed through an examination of the following:

- Hydraulic conditions; specifically, the following assessments are used to indicate if the wall is functioning as designed:
  - Groundwater flow – review of potentiometric maps to see how the barrier wall may be affecting groundwater flow.
  - Hydraulic head differences – review of the direction and magnitude of horizontal gradients across the wall to assess the potential for outward flow and hydraulic connectedness as well as a summary of the direction of vertical gradients between the unconsolidated deposits and underlying bedrock.
  - Hydraulic independence – review of continuous hydraulic head measurements to evaluate whether groundwater within the barrier is acting independently of the groundwater and surface water outside the wall.
- Total arsenic concentrations in groundwater; specifically, whether:
  - Total arsenic concentrations within and outside are consistent with past data and what, if any, changes in the distribution of concentrations can be observed (for example, is the distribution of total arsenic concentrations within the wall becoming more spatially uniform over time).
  - Statistically significant changes in arsenic concentrations over time could indicate that concentrations measured at wells within, outside, and beneath the barrier wall (in bedrock) are increasing or decreasing over time. Specifically of interest are whether data indicate increasing trends are present in wells beneath and outside the wall, and the magnitude of concentrations associated with those trends.

3.1 Summary of System Operations

3.1.1 GWCTS

During the 2018 reporting period, the GWCTS recovered an estimated 1,511,663 gallons of water from the seven extraction wells permanently connected to the system (groundwater recovered during the PDP described in Section 4.6 and subsequently disposed offsite are not included in this total). GWCTS operational data have been provided quarterly to USEPA, with the most recent report covering operations through September 2018 (Tyco 2018a, 2018b, 2018c).

Monthly flow rates during the year (through October 2018) for each of the seven extraction wells (EW-1 through EW-7) are presented in Table 3 and on Figure 4. Figure 4 shows that EW-1, EW-6, and EW-7 generally have been pumped at the highest rates from 2012 through 2018 (EW-1 is in the Wetlands Area, while EW-6 and EW-7 are in the western portion of the Main Plant area). EW-5, in the middle of the Main Plant area, has also been consistently pumping, whereas EW-2, EW-3, and EW-4 have been operated at the lowest average rates. EW-2 is in the southern portion of the former 8th Street Slip, EW-3 is in the former Salt Vault, and EW-4 is in the eastern portion of the Main Plant area. It is important to note that groundwater elevation management of the former Salt Vault and 8th Street Slip was largely maintained through operation of the PDP during most of 2018, which did not involve the operation of extraction wells EW-2 and EW-3.

3.1.2 Phyto-Pumping System

During the reporting period, maintenance of the phyto-pumping system was completed according to the *Operation and Maintenance Plan, Revision 1 for Onsite Groundwater Management, September 2010* (CH2M 2010b). Because the trees have reached maturity, inspections are now limited to assessment for unusual tree die off. No unusual die off was observed during the inspection completed by June 29, 2018.

3.2 Hydraulic Conditions

To evaluate the containment barrier wall's effectiveness, the corrected manual DTW was used to evaluate horizontal and vertical hydraulic components of groundwater flow and compare groundwater elevations to the Menominee River water levels as discussed below. The approximate depth intervals for existing wells screened at the site and the convention used for well names at this site are as follows:

- "S" = shallow wells—screened zone typically from 5 to 15 feet bgs (10-foot screens) in the alluvial sand and fill deposits. Select S wells are partially screened across varying thicknesses of discontinuous peat deposits near the shoreline near the former Salt Vault.
- "M" = "medium depth" or "intermediate" wells—screened typically from 25 to 30 feet bgs (5-foot screens). These wells are typically screened above the glacial till within the lacustrine silt and sand; however, at some locations, the M wells are screened within the glacial till.
- "D" = deep wells installed and sealed within the uppermost portion of bedrock using a 5-foot-long screen. (Note: In recent historical reports, some of the bedrock wells were assigned a "BR" designation. In this report and for the future, the bedrock wells are regarded as "D" wells.)
- "P" = shallow alluvium and fill wells, screened above a discontinuous peat layer within the former Salt Vault.
- "EW" = extraction test well – two of these wells were double-screened with a shallow (upper) screen and a medium depth (lower) screen in the lacustrine silt or within the till (EW-11 and EW-12).
- "BT" = bedrock test well.
- "R" = replacement well.

3.2.1 Groundwater Flow

Figures 5A, 5B, 6A, and 6B present potentiometric contour maps for the S and D wells developed using data from April and September 2018. As illustrated on the groundwater contour maps for the S wells (Figures 5A and 6A), the effects of the pumping wells and barrier walls are observed through varying head differences between each monitored containment area (the Main Plant, former Salt Vault, former 8th Street Slip, and Wetlands Area). The varying heads shown in the contour maps for the S intervals show groundwater flow patterns within the containment area that vary significantly from those outside the area.

Within the Main Plant containment area, the distribution of the S well (Figure 5A) groundwater elevations in April 2018 show the effects of the pumping wells through varying flow patterns within the Main Plant, with a general flow direction from east to west/northwest, which is consistent with the higher levels of pumping on the western side of the Main Plant area at EW-5, EW-6, and EW-7. In September 2018, the distribution of the S well (Figure 6A) groundwater elevations were relatively flat across the Main Plant because of mechanical issues at the GWCTS that resulted in no pumping within the Main Plant for an extended period. Depending on location and time, groundwater heads within the Main Plant containment area have been both higher and lower than groundwater levels at the exterior of the barrier wall. Shallow groundwater upgradient of the site is being diverted laterally around the barrier wall, which is an indication of the effectiveness of the barrier wall.

As expected, the unique distribution of shallow groundwater elevations within each containment area varies significantly from the distribution of heads measured within the bedrock wells during the same monitoring events (Figures 5B and 6B). Bedrock groundwater heads were significantly less variable, and consistent with past events, the potentiometric contour maps indicate bedrock groundwater was relatively higher in the south-central portion of the site and moves in a relatively northwest and northeast direction from this higher area with a limited horizontal hydraulic gradient. As anticipated, flow patterns within the bedrock remain unaffected by the barrier wall, which was designed to contain groundwater within the overlying unconsolidated deposits and not in bedrock. In general, the groundwater elevation contour maps are consistent with past events and indicate the barrier wall is functioning as designed.

3.2.2 Hydraulic Head Differences

3.2.2.1 Horizontal Gradients

Horizontal hydraulic gradients are listed in Table 6, which presents head differences in monitoring wells located adjacent to each other on either side of the barrier wall as measured during the May 2014 through September 2018 events. While the gradients across the wall indicate if there is a potential for flow to occur to or from the containment area, the difference between the heads also provides an indication of whether a hydraulic connection across the wall is likely.

Table 6 shows that groundwater elevations collected from the “S” and “M” wells during the April-May and September 2018 monitoring events upgradient of the site were lower inside the wall than outside the wall at all locations, except for the April-May 2018 event at MW103S/MW104S and both 2018 events at MW064M/MW102M. The higher elevations on the upgradient portion of the barrier wall are the result of mounding on the upgradient side, which shows the wall is serving as an effective barrier.

Cross-gradient monitoring well groundwater elevations along the western (Main Plant) area of the site were predominantly higher inside the barrier wall than outside the barrier wall during both the April-May and September 2018 monitoring events. This condition may be the result of known/observed localized surface water infiltration at the MW105 monitoring well nest (the well nest recently underwent repairs, including well casing extensions and protective pipe addition, to minimize this condition) and a nearby water main break. In addition, the MW106 well nest is in a small area of grass surrounded by asphalt cover, providing for localized surface water infiltration near this well nest. While the MW003 well nest (located outside the barrier wall near the MW106 well nest) also is in a small area of grass cover, the area is topographically higher than the surrounding area, allowing for relatively more surface water runoff away from the area of the wells. Cross-gradient monitoring well groundwater elevations along the eastern (wetlands) area of the site were predominantly lower inside the barrier wall than outside the barrier wall during the April-May and September 2018 monitoring events.

In general, the difference in groundwater elevations inside versus outside the barrier wall suggest the wall is serving as an effective barrier. Continuous hydraulic head data and the absence of increasing arsenic concentration trends in groundwater outside the wall (except MW102S and MW104S), as discussed in Sections 3.2.3 and 3.3.2, provide evidence of the effectiveness of the wall at these locations.

Groundwater heads from bedrock wells that are inside the barrier wall (screened below the wall) generally were similar to those in the adjacent exterior bedrock wells (Table 6), less than 0.48 foot head difference across all locations in April-May and September 2018. The exception to this was the MW105D/MW040D pair, which had up to a 2-foot variance based on data collected during the April-May 2018 event, but had issues with a water main break and surface water infiltration into the MW105 well nest, as discussed in Section 2.2.

A comparison of groundwater elevations between site wells adjacent to the Menominee River and staff gauge (SG4) data collected in April-May and September 2018 indicate groundwater elevations were generally higher than the river in the Main Plant, varied in the Wetlands Area (likely the results of evapotranspiration), and were lower than the river following re-commencement of the PDP in the former Salt Vault and former 8th Street Slip areas.

3.2.2.2 Vertical Gradients

Vertical gradients have been calculated using the hydraulic head data collected at monitoring well nests across the site (within and outside the containment areas) during the April-May and September 2018 events. Tables 7 and 8 summarize the results for wells outside and within the barrier wall for the 2014 through 2018 sampling events, respectively. Vertical gradients between the S and M unconsolidated wells as well as between the M depth and D (bedrock) wells have each been calculated. The discussion of these data focuses on the gradients that were measured between the unconsolidated and bedrock deposits (M versus D wells). While the utility of these data for evaluating the effectiveness of the wall is limited, they are included herein to allow for their comparison against past conditions. The data are generally consistent with previous reports (CH2M 2012c, 2013b, 2014a, 2015d; Tyco 2016a, 2017a, 2018d).

In general, the direction of the vertical gradients (up vs. down) between the M and D wells upgradient and outside the barrier wall are predominantly downward (Table 7). This is due to the buildup of the heads in the unconsolidated deposits just upgradient of the site caused by the barrier wall; a corresponding buildup of heads in bedrock here is not observed (see above). Within the barrier wall, the direction of the vertical gradients between the M and D wells vary (Table 8). For example, within the former 8th Street Slip area, the relatively higher extraction rates from wells screened in unconsolidated deposits during implementation of the PDP created an upward gradient that was observed during the 2018 monitoring events. Elsewhere where extraction rates are limited, downward gradients between the unconsolidated deposits and underlying bedrock are present, except in the Wetlands Area during the September 2018 event where evapotranspiration likely contributed to the upward gradient and in the MW105 and MW040 monitoring wells where infiltration issues have occurred in the past.

The spatial variability in the direction of vertical gradients that is observed within the wall relative to that observed beyond the wall indicate these two hydraulic systems are acting independently. Within the barrier wall, the distribution of upward and downward vertical gradients is largely controlled by the ongoing shallow groundwater extraction efforts, evapotranspiration, and proximity of well nests to localized infiltration areas (grass areas) within the barrier wall. Conversely, the river, and to an extent the barrier to flow that is created by the upgradient portion of the containment wall, appear to continue to control the direction of vertical hydraulic gradients at locations outside the barrier walls.

3.2.3 Hydraulic Independence

Pressure transducers for collecting continuous hydraulic head data from the wells screened at various depths and locations across the site and from the adjacent surface water of the Menominee River were installed in 2016 at locations required in the BWGMPU. Collection of these data is ongoing. As part of the 2018 annual report, continuous head data collected using the transducers were used to evaluate whether heads within the contained unconsolidated deposits are acting independently from those outside the wall (groundwater and surface water) and within the underlying bedrock. Transducer data graphs are provided in Appendix C.

3.2.3.1 Former Salt Vault

Three transducers are installed in the former Salt Vault area at monitoring wells MW002S, MW115S, and MW119D to monitor water levels over time. Data obtained from monitoring wells MW002S and MW115S document the response of groundwater in this containment area during pumping operations associated with the PDP. During periods of non-pumping, these former Salt Vault monitoring wells screened in the unconsolidated deposits appear to behave independently of water level fluctuations in the river, which is consistent with 2016 and 2017 observations (Appendix C, Figures 1a and 1b). The transducer data are consistent with manual water level measurements obtained as part of the PDP (Figure 7A). MW119D, completed within bedrock, had limited data usability because of the significant drawdown and slow recharge of the well associated with groundwater sampling activities; however, MW119D was replaced with a 30-pound per square inch gauge (psig) transducer on February 21, 2018 (was 15 psig), in an effort to better record data obtained throughout the year. Section 4.6 contains additional details about the PDP.

3.2.3.2 Former 8th Street Slip

Two transducers are installed in the former 8th Street Slip at monitoring wells MW120S and MW120D to monitor water levels over time. Data obtained from monitoring well MW120S documents the response of the groundwater elevation in this containment area during the pumping operations associated with the PDP. During periods of non-pumping, this monitoring well screened in the unconsolidated deposits appears to behave independently of water level fluctuations in the river, which is consistent with 2016 and 2017 observations (Appendix C, Figure 2). The transducer data are consistent with manual water level measurements obtained as part of the PDP (Figure 7B). Data obtained from monitoring well MW120D indicate pumping operations within the area are not affecting the bedrock aquifer. Consistent with bedrock wells across the site, hydraulic heads in bedrock here are closely correlated with the river level elevations. Section 4.6 contains additional details about the PDP.

3.2.3.3 Wetlands Area

Four transducers are installed in the Wetlands Area at monitoring wells MW047S, MW047D, MW109S, and MW109D to monitor water levels over time. One additional monitoring well beyond and adjacent to the Wetlands Area (MW100S) also is outfitted with a pressure transducer for comparison. Data obtained from monitoring wells MW47S and MW109S, located inside the barrier system and screened in the unconsolidated aquifer, show higher water levels in the summer and early fall timeframe with significant decreases in water levels during the growing season when recharge was reduced and evapotranspiration in the phyto-pumping plot in the Wetlands Area is at its maximum for the year.

Water levels within the Wetlands Area were generally lower than water levels measured outside the wall and within the river during the July through September period. These Wetlands Area monitoring wells screened in the unconsolidated deposits appear to behave independently of water level fluctuations in the river (Appendix C, Figures 3a, 3a-1, 3b, and 3b-1). Consistent with past monitoring periods, bedrock monitoring wells MW047D and MW100D largely mimicked the river fluctuations throughout the monitoring period. The water levels measured in monitoring well MW100S located outside the barrier system also mimic the river water level fluctuations; however, the fluctuations are much more subdued when compared to the bedrock water level response to river level fluctuations, but also show similar response to reduced recharge and evapotranspiration from native plants in the unconsolidated aquifer during the growing season.

3.2.3.4 Main Plant

Twelve transducers are installed within the Main Plant area in a series of five monitoring well nest clusters at monitoring wells MW003S, MW064S, MW064D, MW102S, MW106S, MW106D, MW108S, MW108D, MW117S, MW117D, MW118S, and MW118D. Two of these monitoring wells (MW003S, and MW102S) are outside the containment barrier; the remaining monitoring wells are within the footprint of the Main Plant. MW003S and MW106S in the northwestern corner of the site generally show the water levels in the unconsolidated aquifer are higher inside the barrier system compared to outside the barrier system (Appendix C, Figure 4a). The difference in head elevations across the wall here indicate the barrier wall is an effective hydraulic barrier. Data obtained from monitoring well MW106D document water levels in bedrock generally mimic changes in water levels in the river.

Monitoring wells MW064S, MW064D, and MW102S are in the south-central portion of the Main Plant area. Monitoring well MW102S is outside the barrier wall, while MW064S and MW064D are within the footprint of the Main Plant barrier system. Data obtained show that water levels in the unconsolidated aquifer outside the barrier wall near MW102S are significantly higher than inside the barrier wall (MW064S), which suggests the wall is acting as an effective hydraulic barrier between the two areas (Appendix C, Figure 4b).

Water level data obtained at MW064S, which is within a phyto-pumping plot, also show the significant reduction in water levels in the unconsolidated aquifer during the growing season followed by a relative rise in water levels when evapotranspiration is at a minimum during late fall and winter. Data obtained from monitoring well MW064D document the independence of water levels in bedrock when compared to the unconsolidated aquifer. Water levels in bedrock generally mimic changes in water levels in the river. It should be noted that the transducer from monitoring well MW102S was temporarily removed on February 21, 2018 and replaced July 19, 2018 to allow for per- and polyfluoroalkyl substances sampling.

Monitoring well nests MW117S/MW117D and MW118S/MW118D are in the northwestern and north-central portions of the Main Plant, respectively, adjacent to the river. Data obtained from the monitoring wells document the unconsolidated aquifer behaves independently from river fluctuations, indicating the barrier between the river and the unconsolidated aquifer in this area is effective (Appendix C, Figures 4c, 4c-1, 4d, and 4d-1). Measured heads in monitoring well MW117D, completed in bedrock, generally mimic the changes in the water levels in the river. Data obtained from monitoring well MW118D indicate operational irregularities with the transducer during the monitoring period, and data download activities were difficult as the monitoring well was frozen during the winter download and observed under a large snow pile during the spring download events. MW118D was planned to be replaced with a 30 psig transducer (was 15 psig) to better record data throughout the year, as most of the data obtained are not representative and not usable at this time; however, MW118D was found to have a cracked/offset casing on June 13, 2018 and was abandoned in early September 2018 with plans to replace MW118D in 2019.

Monitoring wells MW108S and MW108D are near the river adjacent to the southern portion of the Turning Basin and within the footprint of the barrier system. Data obtained from monitoring well MW108S show that the unconsolidated aquifer behaves independently from the river fluctuations, indicating the barrier between the river and unconsolidated aquifer in this area is effective (Appendix C, Figures 4e and 4e-1). It should be noted that the transducers from monitoring wells MW108S and MW108D were temporarily removed on February 21, 2018 and replaced July 19, 2018 to allow for per- and polyfluoroalkyl substances sampling. Data obtained from monitoring well MW108D also indicate operational irregularities from December 2017 through the end of February 2018, rendering the data unusable. The transducer in MW108D was replaced with a 30 psig transducer (was 15 psig) on July 19, 2018 to better record data throughout the year, as most of the data obtained prior to this time are not representative and determined not usable at this time. The July 19, 2018 on-transducer readings at MW108D generally follow the river fluctuations, but these fluctuations are more muted than typically seen at other bedrock wells.

3.3 Total Arsenic in Groundwater

Total arsenic concentrations were evaluated to identify trends and distribution in site groundwater since barrier wall completion in fall 2010 and relative to the 2009 baseline groundwater sampling event.

3.3.1 Arsenic Distribution

Total arsenic was detected above the method detection limit in 49 of the 51 groundwater samples collected during the May 2018 sampling event, with detected concentrations ranging from an estimated 2.5 µg/L in groundwater collected from monitoring well MW021M in the southeastern portion (Wetlands Area) of the site to 4,200,000 µg/L in groundwater collected from monitoring well MW120M in the former 8th Street Slip area.

Total arsenic was detected above the method detection limit in 43 of the 47 groundwater samples collected during the September 2018 sampling event, with detected concentrations ranging from an estimated 2.5 µg/L in the groundwater sample collected from monitoring well MW104M in the southwestern portion of the site to 1,900,000 µg/L in the groundwater sample collected from MW109M in the northwestern portion of the Wetlands Area. Laboratory results for the May and September 2018 sampling events are summarized in Table 9.

In general, the highest arsenic concentrations were observed in the northern portions of the site. Consistent with past sampling events, M wells had the overall highest concentrations. Concentrations in S wells were generally one to two orders of magnitude lower than corresponding M well concentrations. Similarly, concentrations in D wells also were generally orders of magnitude less than concentrations in overlying M wells. The highest concentration in bedrock groundwater (480,000 µg/L) was collected in May 2018 from bedrock monitoring well MW120D in the former 8th Street Slip area of the site. Summaries of baseline and post-barrier wall installation total arsenic in groundwater data are presented in Table 9 and on Figures 8A, 8B, and 8C for S, M, and D wells, respectively.

Total arsenic detection frequency, range of detected values, and exceedances of Wisconsin Department of Natural Resources (WDNR) standards for dissolved arsenic (for comparison) are summarized in Table 10 for the annual barrier wall groundwater monitoring events. Detection and exceedance frequencies are similar across all monitoring events. It is important to note that select wells within the former Salt Vault and former 8th Street Slip are only sampled annually as required by the revised BWGMPU (CH2M 2015a). Because the concentrations of arsenic in groundwater collected from these wells represent some of the highest detected at the site, the median and average arsenic concentrations within the barrier wall and within bedrock appear significantly elevated due to including these data in the analysis of the arsenic concentrations presented in Table 10; therefore, data from event to event are not always directly comparable.

3.3.2 Arsenic Trend Analysis

A Mann-Kendall statistical trend analysis of total arsenic concentrations over time was performed for wells with four or more sampling events. Statistical evaluation of trends in chronological data can be pursued in several ways. One of the most used trend analysis methods for environmental data is the Mann-Kendall test (Gilbert 1987; Gibbons 1994). This is a nonparametric method, so there are no distributional assumptions, nondetect data values are more easily handled, and irregularly spaced sampling intervals are permitted. The Mann-Kendall test was performed with data beginning in 2009, which results in 53 BWGMPU program wells at the site with at least four sampling results, the minimum number of samples needed to calculate a statistically significant (at the 95% confidence level) trend. The reliability of the Mann-Kendall test increases with sample size, and sample sizes of 8 to 10 are recommended; 41 of the 53 locations analyzed had 8 or more sampling results. Nondetect values were input at a concentration lower than the lowest detected (or estimated) concentration, in accordance with USEPA guidance (USEPA 2009b). The analyses were conducted using USEPA software program ProUCL 5.1.002 (USEPA 2013).

The Mann-Kendall test represents the probability that any observed trend would occur purely by chance (given the variability and sample size of the dataset). A significance level of 0.05 was used for comparisons with this calculated probability (that is, there is 95% confidence that the observed trend is real), and the resulting decision is reported. If the calculated probability is greater than or equal to 0.05, the conclusion is drawn that there is no significant trend. If the calculated probability is less than 0.05, then the conclusion is drawn that an increasing or decreasing trend has occurred, depending on the trend in the data (that is, positive or negative slope).

An evaluation for the coefficient of variation (CoV) of the data associated with monitoring wells identified with "No Significant Trend" also was completed. The CoV is recognized as an acceptable measure of intrinsic variability in positive-valued data sets and can be used as an indication of stability. The CoV is a relative measure of variation described by the ratio of the sample standard deviation to the sample mean. Values less than or near 1.0 indicate that the data form a relatively close group about the mean value. Values larger than 1.0 indicate that the data show a greater degree of scatter about the mean. It should be noted that the CoV is a relative measure of variation in groundwater concentration data and can be affected by the magnitude of concentration. As such, relatively higher concentrations can include significant variation while exhibiting a small CoV.

Table 11 summarizes the results of the Mann-Kendall test for intrawell trends of the selected wells and more detailed results of this analysis are provided in Appendix D, including the calculated probability for the Mann-Kendall test provided in Table D-1. Figure 9 depicts the observed trends spatially. Based on the Mann-Kendall statistics (including the CoV evaluation), groundwater results from 32 of the 53 wells display stable or decreasing trends, 10 locations display no significant trend, while 12 locations indicate an increasing arsenic concentration trend. Nine of the groundwater results displaying increasing trends are from groundwater collected within the barrier wall system, 2 out of 12 are from outside the barrier wall, and 1 out of 14 is from the bedrock beneath the site. The increasing trends observed within the barrier wall system are likely the result of redistribution of arsenic-impacted groundwater due to localized hydraulic gradients related to areas of pumping and recharge. For those wells demonstrating increasing trends outside the barrier wall system, the following observations can be made:

- The observed increasing trends at two wells outside the barrier wall system are from the localized redistribution of arsenic that existed before the wall installation for the following reasons:
  - The arsenic concentrations at these wells are relatively low (89 and 110 µg/L at MW102S, and 6.1 [below the maximum contaminant level {MCL}] and 27.0 µg/L at MW104S) and considerably lower than concentrations observed inside the barrier wall at MW064S (1,100 and 2,000 µg/L) in May and September 2018, respectively.
  - An outward hydraulic gradient, which would be necessary to advectively transport arsenic from inside the barrier wall to outside the barrier wall, is not present in 10 of 10 dates (2014 to 2018) for MW102S/MW064S and 9 of 10 dates (2014 to 2018) for MW103S/MW104S (Table 6).
  - The assumption used at all locations to handle nondetect results may not be valid for MW104S. The use of a proxy value is required for nondetect results (earliest nondetect results of 20 UB µg/L in June 2011 and June 2012 at MW104S), that is lower than any concentration previously detected (6.1 µg/L at MW104S). The sensitivity of the calculation at MW104S is such that if this proxy value were increased by 0.1 µg/L to 6.2 µg/L then the Mann-Kendall analysis would indicate no significant trend.
- Although the Mann-Kendall test indicated an increasing trend at MW064D, the highest observed arsenic concentration at MW064D is the earliest (June 2011) reported concentration of 1,470 µg/L. Subsequent concentrations have been between 330 and 860 µg/L. The increasing trend reported by the Mann-Kendall analysis appears to be the result of slightly higher concentrations in 2017 and 2018 (610 to 860 µg/L) than in 2012-2016 (330 to 530 µg/L).

3.4 Volatile Organic Compounds

Groundwater samples were collected during the May 2018 sampling event from eight locations at the site within the barrier wall to assess VOC concentrations in accordance with the BWGMPU. Four of the locations (MW041S, MW041M, MW045S, and MW045M) were sampled during previous sampling events (calendar years 2000[2], 2009, and 2015); four of the groundwater sample locations (MW108S, MW108M, MW117S, and MW117M) were only previously sampled during the 2015 sampling event. Table 12 presents the detected analytical results of the groundwater samples collected during the May 2018 sampling event and historical VOC data collected during previous sampling events.

In 2018, 29 compounds were detected in groundwater, 17 compounds were detected above the Wisconsin Administrative Code Chapter NR 141 preventative action limit (PAL), and 15 compounds were detected above the enforcement standard (ES) in one or more of the groundwater samples collected from the monitoring wells; the compounds with exceedances are summarized below. The remaining compounds analyzed were not detected in the groundwater samples.

- Benzene – estimated 5.6 µg/L in MW041M to 100 µg/L in MW108S and MW108M
- Chlorobenzene – estimated 3.3 µg/L in MW041M to 3,800 µg/L in MW045S
- 1,2-Dichlorobenzene (1,2-DCB) – 21 µg/L in MW117S to 1,800 µg/L in MW045S
- 1,4-DCB – 1.9 µg/L in MW117S to 84 µg/L in MW045S
- 1,2-Dichloroethane – estimated 18 µg/L in MW045S
- 1,1-Dichloroethene (1,1-DCE) – estimated 0.66 µg/L in MW041M to estimated 3.9 µg/L in MW045M
- cis-1,2-DCE – 2.0 µg/L in MW117S to 390 µg/L in MW045S
- Ethylbenzene – estimated 1.6 µg/L in MW041M to 1,500 µg/L in MW041S
- Methylene chloride – estimated 4.4 µg/L in MW117S to 120 µg/L in MW041M
- Naphthalene – estimated 1.5 µg/L in MW117M to 150 µg/L in MW108M
- Toluene – 7.5 µg/L in MW108S to 3,900 µg/L in MW045S
- Trichloroethene – 1.4 µg/L in MW117M to 1,700 µg/L in MW045M
- Vinyl chloride – estimated 0.97 µg/L in MW117S to estimated 54 µg/L in MW045M

[2] 2000 data were collected by URS Corporation (URS) as part of the 2000 *RCRA Facility Investigation* (URS 2001).

- Xylenes – estimated 8.2 µg/L in MW041M to estimated 9,100 µg/L in MW041S
- Acetone - 100 µg/L in MW117M to 3,900 µg/L in MW045S
- 4-Methyl-2-pentanone – estimated 43 µg/L in MW041S to 1,200 µg/L in MW045M
- 1,4-Dioxane – estimated 55 µg/L in MW041M

3.5 2018 Barrier Wall Survey and Visual Inspections

An inspection of the barrier wall was completed in May 2018 as part of the requirements in the *Operation and Maintenance Plan, Revision 1 for Onsite Groundwater Management, September 2010* (CH2M 2010b). The inspection included collecting survey-grade measurements of the horizontal location of established points every 50 feet along the wall. Because of the sediment removal and sheet pile stabilization activities that were conducted from 2012 to spring 2015, which can alter the dynamic forces on the sheet pile wall, a survey was completed in May 2015 to re-baseline the horizontal and vertical location of the sheet pile barrier wall.

A comparison of survey results from the June 2015 and May 2018 surveys indicate that only two survey points had greater than 1 inch of movement, with a maximum horizontal and vertical deflection of 0.093 foot and 0.049 foot, respectively. The deflections reported are within the tolerances expected based on survey accuracy, temperature stress on the steel, and movement in the soil except for two locations that slightly exceeded general tolerances. The two locations that exceeded are at the last two points on the eastern end of the sheet pile wall in the Wetlands Area and will continue to be monitored as part of future surveying activities.

Visual inspections of the barrier wall were completed on May 10 and October 25, 2018 in accordance with the BWGMPU (CH2M 2015a). A summary of the inspection details from the May 10, 2018 event were submitted to USEPA in the July 16, 2018 quarterly progress report (Tyco 2018b). A summary of the findings and subsequent repairs are presented as follows:

- The May 10, 2018 inspection identified approximately 20 waler bolt locations with minor leakage due to loosening of the waler bolt and 1 seam location along the wall.
- On August 14, 2018, these waler bolts were tightened, and marine caulk (JB Marine Weld) was placed around the bolts and bolt plates. For the wall seam location, soil was removed from behind the wall and backfilled with bentonite. In addition, Tyco elected to conduct limited preventative maintenance by tightening bolts and placing marine caulk around some additional waler bolts that did not exhibit leakage. The maintenance services were performed by MJB Industries.
- During the October 25, 2018 inspection, 16 waler bolt locations were observed to have minor leakage.
- During the week of October 29, 2018, MJB Industries performed waler bolt tightening and placing marine caulk for the waler bolts noted to have the minor leakage.

No other issues were identified during the inspections.

3.6 2018 BWGMPU Conclusions

Continued evaluation of the barrier wall indicates it is an effective hydraulic barrier to groundwater flow in the unconsolidated deposits. Based on the data and information collected to date, the following conclusions have been made.

- As of October 2018, of the entire BWGMPU network of 61 wells, all were confirmed to be in good condition as well as staff gauge SG4, except MW118D, which had an offset identified in the casing and was abandoned in August 2018.
- Shallow depth groundwater contours show that groundwater upgradient of the site is being diverted around the barrier wall, and different flow patterns that are inconsistent with pre-barrier wall conditions are present within each containment area. These effects are not observed in bedrock. The

observed flow patterns provide a line-of-evidence that the wall is serving as an effective barrier to groundwater flow in the unconsolidated deposits.

- The majority of near-wall monitoring couplets across the site showed either inward gradients across the wall (no outward flow potential) and/or significant head differences that suggest the wall is serving as an effective hydraulic barrier.
- The direction of vertical gradients between the unconsolidated deposits and bedrock varies across the site depending on the amount of pumping that is occurring in each area within the unconsolidated deposits. Within those areas of relatively low pumping rates, heads are higher in the unconsolidated deposits and downward vertical gradients are observed. The presence of a downward gradient does not indicate flow is occurring.
- Pressure transducers have been installed in selected wells across the site. In general, the transducer data indicate:
  - The barrier wall is effectively separating the onsite unconsolidated aquifer from the river and the groundwater system beyond the barrier system.
  - Data obtained from bedrock monitoring locations show groundwater levels behave independently from the unconsolidated aquifer. At most of the locations, bedrock locations generally mimic changes in river water levels; this is not the case for collocated shallow wells inside the wall. These data suggest the glacial till separating the arsenic impacted water-bearing unconsolidated deposits from the underlying bedrock serves as an effective hydraulic barrier.
  - Groundwater levels within the former Salt Vault were lowered an average of 4.8 feet during PDP operations and were maintained slightly above the target elevation, while the groundwater levels were lowered an average of 7.3 feet in the former 8th Street Slip and was maintained below the target elevation since June 2018 as part of the PDP. Details of the PDP operations are discussed in Section 4.6.
- A quantitative assessment of the available data (using the Mann-Kendall test) obtained from June 2009 to September 2018 indicate total arsenic concentration trends are consistent with an effective barrier system:
  - In general, total arsenic concentrations outside the wall tend to be lower when compared to adjacent well nests measured inside the wall, and 14 of the 16 wells outside the wall have decreasing, stable, or no concentration trends. Total arsenic concentrations in S wells are generally lower than M wells. D well concentrations are generally lower than overlying total arsenic concentrations in both the M and S wells.
  - The results of the Mann-Kendall trend analysis indicate the barrier wall is operating effectively. The results of this evaluation show that of the 53 wells with four or more sample results, 29 well locations display stable or no significant concentration trends. Twelve of the groundwater sample locations display statistically significant decreasing arsenic concentrations trends, while 12 of the groundwater sample locations display statistically significant increasing arsenic concentrations.
  - Only 2 of 12 S/M wells outside the barrier wall and 1 of 14 bedrock wells exhibited an increasing trend. These trends are not steep, and more time is needed to assess overall trends.
- Seventeen VOCs were detected above the PAL in one or more of the eight groundwater samples collected during the May 2018 sampling event, with the following results.
  - Concentrations of benzene, chlorobenzene, 1,2-DCB, cis-1,2-DCE, 1,4-DCB, 1,2-dichloroethane, ethylbenzene, methylene chloride, naphthalene, toluene, trichloroethene, vinyl chloride, xylenes, 1,4-dioxane, and 4-methyl-2-pentanone were identified in one or more of the groundwater samples at concentrations exceeding the PAL and ES.
  - Concentrations of acetone and 1,1-DCE were identified in one or more of the groundwater samples at concentrations exceeding the PAL but below the ES.
  - All other concentrations detected in previous sampling events were either nondetect or below the PAL and ES.

- Based on the limited dataset over time, no definitive concentration trends may be determined at this time. However, the effectiveness of the barrier wall, as demonstrated by the barrier wall monitoring data, prevents migration of the VOCs from the facility.

- The barrier wall visual inspection and surveys indicate the barrier wall structural integrity remains intact. Limited general maintenance tasks were completed in accordance with the *Operation and Maintenance Plan, Revision 1 for Onsite Groundwater Management, September 2010* (CH2M 2010b) and further described in the BWGMPU (CH2M 2015a).

Based on the conclusions, no changes or corrective actions are needed as part of the barrier wall groundwater monitoring. It is recommended that semiannual sampling occur for 1 more year in 2019 and then the frequency evaluated as part of the 2019 annual report.

4. Status of the Remedy

The components of the required corrective action remedy are presented in the 2009 AOC and the subsequent 2014 AOR (USEPA 2009a, 2014a). The following subsection further describes the components of the remedy listed in Section 1.5 and presents the status for each component.

All primary components of the AOC remedy have been implemented at the site in accordance with the AOC and approved plans. The primary components were previously described in the 2013 5-year technical review document (CH2M 2013c, 2014a) and are further summarized below with additional details regarding updates/ further activities associated with each primary component. In addition, the 2014 AOR remedy enhancement and the outfall investigation component have been initiated and either have been fully implemented or are in progress. The components of the enhanced remedy and their status, performance, and appropriateness also are described in detail below.

4.1 Institutional Controls

In accordance with Section VI.11. paragraph a of the AOC (USEPA 2009a), Tyco has implemented all required institutional controls for the site, which include:

- Recorded an enforceable deed restriction for the facility on February 17, 2010. A copy of the deed restriction was provided in a letter from Foley and Lardner LLP to the agencies on February 23, 2010.
- Provided written notification on February 23, 2010 (CH2M 2010c) to USACE and WDNR to restrict dredging, trenching, and digging in the Menominee River Turning Basin area (Figure 10).
- Coordinated with the City of Marinette to adopt a "No Anchoring Area" Ordinance that will prohibit anchoring within the contaminated sediment area of the Menominee River (Figure 10). Ordinance 2175 was adopted on May 20, 2010.
- Posted "No Anchoring" signs on June 18, 2010 that informs boaters of the anchoring restrictions in the contaminated sediment area. Signs were posted at the Tyco facility property viewable from the Turing Basin area and five public boat launches in Marinette, Wisconsin and Menominee, Michigan. Signs placed at the public boat launches identify the designated area where anchoring is not to be allowed and the general location of the boat launches in relation to the designated area.

The implementation of the institutional controls was documented in a letter from CH2M to USEPA on June 24, 2010 (CH2M 2010d). "No Anchoring Area" signs at the facility and at the boat launches remain in place to date.

4.2 Soil Remediation

Section VI.11 paragraph c of the AOC required placement of cover materials over surface soils within the facility with arsenic concentrations greater than or equal to 32 milligrams per kilogram (mg/kg) and remediation of surface soils adjacent to the facility with arsenic concentrations greater than or equal to 16 mg/kg (USEPA 2009a). Eleven areas within the facility (Areas A through K) and three adjacent (Areas L, M and N) required remediation (Figure 11). Tyco has completed all required soil remediation for the site as documented in the construction completion report (CH2M 2010e).

A cover maintenance plan was prepared for the cover area within the facility in accordance with the AOC. The maintenance details are provided in the *Draft Cover Maintenance Plan – Revision 1, Onsite Soil Areas* (CH2M 2010f). The cover areas are annually inspected, and the findings are recorded on an inspection log. Copies of the inspection reports and maintenance logs are retained at the facility. The most recent inspection was completed by June 29, 2018, and findings of this and previous inspections are included in the quarterly reports to USEPA (Tyco 2018b).

The following modifications to the cover areas have been completed:

- Grass cover in Area I was removed in April 2013 in preparation for sediment removal activities. The area was replaced with asphalt as outlined in the *Cover Area I Replacement Letter* (CH2M 2013c).
- A portion of Area G along the riverfront was converted from a soil cover to a gravel cover to support sediment removal activities conducted in 2013-2014. The remaining portion of the soil cover was planted with trees in July 2013. The soil cover in the tree planting area remains in place.
- In 2017, stormwater Outfalls #5 and #6 were converted from underground piping, which ultimately discharged to the Menominee River, to overland flow discharge to the river. The eastern portion of the soil/gravel cover in Area G and Area H were converted to asphalt cover to support modification of these stormwater outfalls. The cover in Area G was previously comprised on riprap and limited soil/grass cover. Area I was further modified by placement of an asphalt berm along the western side of the area (Tyco 2018e).
- The soil/grass cover in the northern portion of Area K was replaced with asphalt in 2017. The area repeatedly had required maintenance because of damage occurring during snow removal activities; therefore, the asphalt cover was placed to minimize future cover disruption (Tyco 2018e).

Cover modification areas are shown on Figure 11.

4.3 Site Security

Section VI, 11, paragraph h of the AOC requires Tyco to control access to the facility to minimize unacceptable risk associated with human exposure to site contaminants (USEPA 2009a). To minimize risk, the property, including the manufacturing area to the west and the undeveloped area to the east, is surrounded by an 8-foot high, chain link fence, except for the riverfront along the Main Channel of the Menominee River. The fence is periodically inspected and maintained. The facility site plan is illustrated on Figure 2. Entrances to the facility are monitored and controlled by site security staff. In addition, Tyco also has a health and safety plan for the site. The health and safety plan requires appropriate personal protective equipment, internal notifications prior to excavation, and management of material according to the regulations.

4.4 Menominee River Sediment Removal

Section VI. 11 paragraphs d and e of the AOC require soft sediment and SCM containing total arsenic concentrations greater than or equal to 50 mg/kg to be removed from the Menominee River adjacent to the facility (USEPA 2009a). Glacial till and bedrock were excluded from the dredging requirement. Monitored natural recovery would then be used to manage areas where the remaining sediment contains between 20 and 50 mg/kg arsenic; the final remediation goal for site sediments is 20 mg/kg total arsenic by 2023, 10 years after sediment removal is completed.

Dredging commenced in 2012, and the removal of soft sediment and SCM in accordance with the AOC requirements was completed in November 2013. Sheet pile stabilization was required to allow dredging of soft sediment and SCM adjacent to the sheet pile wall. This included installing soldier piles, deadmen, walers, and tie-backs. The sheet pile stabilization took place between December 2012 and April 2013. Pursuant to the AOC, a construction completion report (CH2M and Sevenson Environmental Services 2014) documenting the removal and sheet pile stabilization was prepared and submitted to USEPA in March 2014 that details the sediment removal activities.

Tyco, USEPA Great Lakes National Program Office, and WDNR partnered to complete removal of sediments located in the area with arsenic concentrations between 20 and 50 mg/kg to immediately meet the long-term monitored natural recovery goal. This "betterment" project, conducted as part of the Great Lakes Legacy Act program, was completed between September 2014 and June 2015. A total of 41,010 cubic yards (68,672 tons) of additional sediment and SCM were removed from the Menominee River, treated at the facility using procedures consistent with the earlier dredging activities, and subsequently disposed offsite. In addition, a sand cover, consisting of a 12-inch-thick layer of sand mixed with granular activated carbon, was placed over portions of the exposed glacial till that contained arsenic concentrations exceeding 20 mg/kg and in limited areas where site conditions prohibited the removal of SCM (Environmental Quality Management, Inc. 2015).

Because a portion of the dredged area also included the USACE authorized navigational channel, placement depth restrictions (that is, the elevation of the sand cover could not exceed an elevation of 554.5 feet IGLD 1985) limited the area of sand cover placement. Lastly, phragmites eradication was conducted on the Tyco property in fall 2015. Details of the 'betterment" project activities were submitted to USEPA in the December 2015 *Remedial Action Completion Report* (Environmental Quality Management, Inc. 2015). Confirmation sediment sampling results associated with the "betterment" project were reported in the *Sampling Summary Report* and submitted to USEPA (CH2M 2015e). Figures 12A to 12C show the final dredge surface confirmation sampling locations and results, and Figure 13 includes the areas of final cover placement.

An addendum to the 2014 construction completion report was submitted to USEPA on February 1, 2016 (CH2M 2016), per USEPA's request in a June 3, 2014 letter (USEPA 2014c) to summarize the final backfill placement for riprap as referenced in Section 3.6.5 of the construction completion report and final site restoration and decontamination as referenced in Section 3.8.3 upon completion of the sediment work. The addendum document also provided the requested reference documentation completed as part of the 2014 and 2015 "betterment" project (or Legacy Project) corrective measures and summarizes the total dredge and water treated for the two projects. USEPA conditionally approved the construction completion report in a letter dated February 16, 2016 and requested additional documentation for the riprap installed to support the sheet pile barrier wall (USEPA 2016b). The supplemental information addendum deliverable was submitted to USEPA on March 9, 2016 (Tyco 2016b).

4.5 Onsite Groundwater Management

The five-year technical review requirements in the AOC request additional review of the onsite groundwater management component beyond the status/state of the remedy; therefore, this section evaluates the performance to date of the three main technologies from the AOC that comprise the onsite groundwater management component, and also discusses their appropriateness and any proposed modifications. Section VI, 11, paragraph b of the AOC requires several actions for onsite groundwater management, including:

- Installation of a containment barrier around the perimeter of the facility to contain arsenic-contaminated groundwater, to the maximum extent practicable
- Construction and operation of a GWCTS involving both a phyto-pumping and a mechanical pumping system to maintain groundwater elevations within the barrier system to prevent surface flooding
- Performance monitoring of the containment barrier wall system

Tyco has completed or implemented all required onsite groundwater management components for the site; each is summarized below.

4.5.1 Containment Barrier Wall

Pursuant to the AOC, the objective of the containment barrier wall is to provide a below ground barrier, constructed of impermeable materials driven to glacial till or bedrock if no glacial till layer exists, to contain groundwater in the unconsolidated deposits contaminated with arsenic, to the maximum extent practicable. The containment barrier wall is comprised of the following three types of barrier systems and the connections between each: vibrated beam slurry wall, thin diaphragm wall, and sheet pile wall. Barrier walls were installed around the former 8th Street Slip and former Salt Vault areas as part of an interim action between 1999 and 2000.

As part of the AOC requirements, the vibrated beam slurry wall and thin diaphragm walls were installed in 2009 and form the eastern, southern, and western boundaries of the containment structure. The sheet pile wall was installed in 2010 and is located along the northern property boundary with a small portion along the western property boundary. The 1999 to 2000 interim action barrier walls and the 2009 and

2010 walls effectively separate the facility into four containment cells as shown on Figure 1. The containment areas within the vertical barrier wall include:

- Main Plant (western portion of the facility)
- Former Salt Vault (northeastern portion of the facility)
- Former 8th Street Slip (spanning the central portion of the facility)
- Wetlands Area (eastern portion of the facility)

Details on the containment barrier wall systems installed between 2009 and 2010 are provided in the *Construction Completion Report, Containment Barrier Wall Installation* (CH2M 2011a).

Inspections and maintenance of the containment barrier wall are performed in accordance with the *Operation and Maintenance Plan, Revision 1 for Onsite Groundwater Management, September 2010* (CH2M 2010b). Common maintenance activities have included:

- Identifying and filling settlement areas along the land side of the sheet pile wall using gravel and/or soil
- Clearing surface water runoff spillways blocked with hay or other debris
- Replacing missing vertical barrier wall markers along the slurry wall
- Repairing behind the wall by backfilling with grout or bentonite
- Tightening and marine welding bolts exposed on the outside of the sheet pile wall that have become loose over time

Performance Summary

The most recent inspections were completed in May 2018 (inspection and survey) and October 2018 (inspection only). The findings from the May 2018 and prior inspections are included in the quarterly reports to USEPA (Tyco 2018b). Further details on the May and October 2018 inspection and survey results are summarized in Section 3.5. Conclusions on the effectiveness of the wall are included in Section 3.6. Conclusions indicate the barrier wall is an effective hydraulic barrier to groundwater flow in the unconsolidated deposits.

Appropriateness

The wall is working as designed, and conditions indicate the barrier wall is an appropriate remedy for preventing the movement of groundwater through the unconsolidated deposits (Section 3.6). Based on the site hydrogeology, historical concentration profiles, and demonstrated effectiveness of the barrier wall, it is unlikely for site-related groundwater to serve as a continuing source of arsenic to the Menominee River.

Proposed Modifications

No modifications are proposed for the containment barrier wall.

4.5.2 Barrier Wall Monitoring

As required in the AOC, barrier wall groundwater monitoring was conducted in accordance with the 2011 *Barrier Wall Groundwater Monitoring Plan* (CH2M 2011b) and since fall 2015 the BWGMPU (CH2M 2015a). The BWGMPU was prepared by Tyco pursuant to a requirement in the AOR and was approved by the agencies in September 2015 (USEPA 2015a). The BWGMPU incorporated the AOR components into the original *Barrier Wall Groundwater Monitoring Plan* submitted in January 2011.

The objective of the BWGMPU is to assess the effectiveness of the barrier wall and the groundwater management systems in containing contaminated groundwater within the unconsolidated deposits beneath the facility. This includes collecting semiannual groundwater samples from monitoring wells within and outside the barrier wall for the analysis of total arsenic that began in the second quarter of 2011. Water levels were collected quarterly the first year (2011) and have been collected semiannually in the following years (prior to sampling, generally in the second and fourth quarters of the year). The sampling and water level data are reported to USEPA in the quarterly reports submitting since 2011 (CH2M 2011c, 2011d, 2011e, 2012d, 2012e, 2012f, 2012g, 2013d, 2013e, 2013f, 2013g, 2014b, 2014c, 2014d; Tyco 2014, 2015a, 2015b, 2015c, 2015d, 2016c, 2016d, 2016e, 2016f, 2017b, 2017c, 2017d, 2017e, 2018a, 2018b, 2018c, 2018f), and a report is prepared annually to summarize the results and evaluate the barrier wall's effectiveness (CH2M 2012c, 2013b, 2014a, 2015d; Tyco 2016a, 2017a, 2018d).

4.5.2.1 Performance Summary

Based on the results from the data evaluations (June 2011 to September 2018 and baseline in June 2009), conditions continue to indicate the barrier wall is an effective hydraulic barrier to groundwater flow in unconsolidated deposits. Sections 2 and 3 include details on the field activities and detailed evaluation and conclusions of the most recent data. Additional details on activities and performance not included in earlier sections include:

- Eleven monitoring wells and one replacement monitoring well were installed at the facility in 2015, consistent with the requirements of the AOR. These included three nested monitoring wells (S/M/D) at the MW117, MW118, and MW120 locations; and MW107M, MW119D, and a replacement well at the MW021S location. In addition to these referenced wells, monitoring wells MW115P, MW115S, and MW021M were added to the monitoring program (MW115P and MW115S were installed in 2014 as discussed in Section 4.5.3).
- In 2017, transducers originally installed in monitoring wells MW105S, MW105D, and MW040S were moved to monitoring wells MW106S, MW106D, and MW003S. The move was necessary because water level data collected from the MW105/MW040 area was influenced by surface water pooling and infiltrating into the wells, providing unreliable data related to groundwater elevations in the area. Monitoring well nest MW105 had casing extensions and protective pipes installed in August 2018, while monitoring well nest MW040 had the casing repaired and flush-mount covers replaced.

4.5.2.2 Appropriateness

The current BWGMPU is sufficient for continuing to monitor effectiveness of the groundwater management component of the remedy as designed. However, USEPA has requested (during the October 22, 2018 meeting) an addendum to the BWGMPU to further enhance the monitoring network along the Main Plant barrier wall and refine the methods used for data evaluation to replace the dye testing component as further discussed in Section 4.8.

4.5.2.3 Proposed Modifications

Enhancements to the monitoring well network, data collection, and means and methods for evaluating the effectiveness of the barrier wall are being discussed as indicated in Section 4.8. It is anticipated that an addendum to the BWGMPU that details these enhancements will be completed in early 2019, and the improvements will likely be implemented in 2019. The addendum to the BWGMPU will include the following components:

- Installation of five additional water table (shallow) monitoring wells along the Main Plant barrier wall
- Installation and operation of transducers at a selection of monitoring wells
- Evaluation of the transducer data using U.S. Geological Survey (USGS) SeriesSEE at select wells
- Procedure for evaluation using USGS SeriesSEE tool
- Performance of an underwater visual inspection in the Menominee River above the mudline along the Main Plant barrier wall

- Procedures for evaluation if an apparent leak is identified – with first steps being more prescriptive, but later steps more general (for example, providing language around preparing a work plan to further address specific issues as identified)

4.5.3 GWCTS

The primary objective of the GWCTS is to maintain groundwater levels within the containment barrier wall through groundwater extraction. The groundwater levels within the containment areas are maintained at depths below ground surface that prevent groundwater-induced surface flooding within the facility property. The treatment component of the GWCTS was designed to remove arsenic from collected groundwater before discharge to the Menominee River, under WPDES Permit 0001040, obtained from WDNR for operation of the GWCTS.

The GWCTS includes seven extraction wells, conveyance piping, electrical conduit, and a groundwater treatment system. The details of the GWCTS construction are provided in the *Construction Completion Report, GWCTS Installation* (CH2M 2011f). The GWCTS commenced full-time operation in October 2010, with nearly continuous operations since that time. Tyco upgraded the treatment system in 2015 to include the Vibratory Shear Enhanced Processing (VSEP) unit formerly used for water treatment during the sediment removal project. An inclined plate separator also was installed by Tyco in 2016 to more effectively remove suspended solids before groundwater treatment through the existing system.

Maintenance for the individual components of the GWCTS is performed based on manufacturer requirements and recommendations. The monitoring and O&M for the GWCTS are outlined in the *Operation and Maintenance Plan, Revision 1 for Onsite Groundwater Management, September 2010* (CH2M 2010b). The O&M for the GWCTS is an ongoing process, and operation data and findings are included in the quarterly reports to USEPA (CH2M 2011c, 2011d, 2011e, 2012d, 2012e, 2012f, 2012g, 2013d, 2013e, 2013f, 2013g, 2014b, 2014c, 2014d; Tyco 2014, 2015a, 2015b, 2015c, 2015d, 2016c, 2016d, 2016e, 2016f, 2017b, 2017c, 2017d, 2017e, 2018a, 2018b, 2018c, 2018f) with the most recent report being submitted for operation through September 31, 2018 (Tyco 2018c).

Test well and monitoring well installation and aquifer testing activities were conducted in winter and spring 2014. Preliminary borings and test wells were advanced at the site to assess the potential to improve the overall efficiency of the extraction component of the GWCTS. Seven extraction test wells (EW-8 through EW-14) and eight monitoring wells (MW113S, MW113M, MW114S, MW114M, MW115P, MW115S, MW116P and MW116S) screened within the unconsolidated deposits were installed. In addition, two bedrock test wells were installed to further the understanding of the bedrock properties and the hydraulic connection to the unconsolidated deposits (BT-01 and BT-02). The information was gathered to obtain a more accurate estimate for the scope and feasibility of potentially lowering the water table within the former Salt Vault and former 8th Street Slip areas, in light of the AOR. Field activities are summarized in the *Status Report for Test Well Installation Field Activities, January 21 to March 6, 2014* (CH2M 2014e) and *Aquifer Testing Field Activities and Results: April and May 2014* (CH2M 2014f).

4.5.3.1 Performance Summary

The GWCTS has extracted approximately 21.7 million gallons of groundwater since January 1, 2014 (approximately 6.9 million gallons of water in 2014, 6.5 million gallons in 2015, 3.8 million gallons in 2016, 2.9 million gallons in 2017, and 1.5 million gallons in 2018). The extraction volume does not include the volume removed and disposed as part of the PDP described below. Average monthly pumping rates from 2012 through 2018 for each of the seven extraction wells (EW-1 through EW-7 assuming the system were operating 24 hours per day, 7 days per week) are presented in Table 3.

Summaries of the O&M of the GWCTS has been provided as part of the quarterly progress reports (CH2M 2011c, 2011d, 2011e, 2012d, 2012e, 2012f, 2012g, 2013d, 2013e, 2013f, 2013g, 2014b, 2014c, 2014d ; Tyco 2014, 2015a, 2015b, 2015c, 2015d, 2016c, 2016d, 2016e, 2016f, 2017b, 2017c, 2017d, 2017e, 2018a, 2018b, 2018c, 2018f) and include individual flow rates and volume extracted, system shutdowns, and overall rainfall. A yearly summary since 2011 is presented in Table 13.

Discharge to the river is documented in monthly WPDES discharge monitoring reports, which are provided to WDNR as part of the WPDES permit for operation of the GWCTS and also included as attachment in the quarterly report to USEPA. Exceedances of the 680 µg/L total arsenic criteria occurred during the last 5 years (January 2014 to early November 2018) as follows:

- August 11, 2016 – A portion of groundwater extracted during PDP activities was transferred to the GWCTS for treatment. The high concentrations of arsenic in the groundwater exceeded the existing groundwater treatment systems ability to effectively remove sufficient mass of arsenic, resulting in exceedances of discharge limits on July 12, 19 and 26, 2016. Therefore, transfer of groundwater collected from the pump down area to the GWCTS was discontinued. The GWCTS operations were temporarily halted, the system was cleaned (including replacing microfilters), and operations recommenced on August 26, 2016.
- July 13 and 20, 2017 – An exceedance was noted on July 24, 2017 and the GWCTS was taken offline while an investigation of the cause occurred. Tyco determined the VSEP membranes had failed. The system was temporarily operated with the brine reverse osmosis system to maintain compliance while the VSEP membranes were on order and changed out.
- October 6, 2017 – During PDP system testing following receipt of analytical results that documented a discharge criteria exceedance. PDP testing was ceased on that day, and the influent contribution rate from each pump down area cell at the time of system testing termination was approximately 2.5 gallons per minute (gpm) and is further detailed in the 2017 annual report (Tyco 2018d).

Tyco is working with the agencies on the details regarding a WPDES permit variance for arsenic that was initially submitted in 2014 (CH2M 2014g). Tyco is preparing an alternatives evaluation as part of that process that will continue into 2019.

4.5.3.2 Appropriateness

The GWCTS is generally operating as designed by maintaining the groundwater levels in the containment areas and preventing the facility from flooding. However, during system testing conducted in 2017 and further discussed in the PDP Section 4.6, it was determined the existing GWCTS is not capable of treating the PDP groundwater and will require upgrades to allow for treatment of the PDP area groundwater. In addition, as part of the variance process, the agencies are interested in information on the lowest possible WPDES variance criteria for arsenic obtainable to reduce overall mass into the Great Lakes (Lake Michigan); the existing GWCTS has limitations on the capability of treating higher arsenic concentrations (relative to the observed site concentrations) and would reasonably only be able to consistently treat arsenic concentrations to 500 µg/L, even without the PDP groundwater.

4.5.3.3 Proposed Modifications

Modifications and upgrades of the existing groundwater system may be implemented in the future. The modifications would be based on the path forward decided on as part of the WPDES permit variance being evaluated by the agencies. Tyco is collecting additional information requested by the agencies related to the variance. Modifications to the groundwater collection system are discussed in Section 4.6 to support the PDP efforts.

4.5.4 Phyto-Pumping System

The primary objectives for using phyto-pumping at the site is to maintain groundwater levels within the containment area to prevent facility flooding caused by groundwater rising to the ground surface and minimize operation of the GWCTS to manage groundwater at the facility. The phyto-pumping system is intended to augment the GWCTS. Zones of trees initially were planted in 2006 and 2008 in the southern portion of the Main Plant and 2008 in the Wetlands Area. These tree plots were supplemented in 2010, along with additional plantings in other areas of the facility in 2010 and 2013, bringing the total number of trees planted for phyto-pumping to approximately 1,400.

O&M of the phyto-pumping system is completed according to the *Operation and Maintenance Plan, Revision 1 for Onsite Groundwater Management, September 2010* (CH2M 2010b). Phyto-pumping system inspections were performed during the growing seasons, as needed. The inspections include evaluations of weed control needs and barriers; animal, pest, and insect control needs; deer fence maintenance; general tree and shrub health; pruning or thinning needs; the appearance of the soil cavity around the trunk; and irrigation needs. Most of the tree plantings have reached maturity (except for two planting areas along the riverfront). Based on information provided by the consultant performing the inspections, concerns of tree health related to weed control needs, animal and pest control, deer fencing condition, and general pruning and thinning needs are limited because of the maturity of the trees. Periodic inspection for substantial tree die off will continue to be conducted and completed by Tyco annually.

4.5.4.1 Performance Summary

Based on the maturity of the trees, evapotranspiration rates for the total phyto-pumping system is approximately 1,000,000 gallons per acre during the growing season (or over 4,000,000 gallons site wide).

4.5.4.2 Appropriateness

The phyto-pumping system will continue to be used as part of the groundwater management strategy at the site. The phyto-pumping system helps to reduce the volume of water requiring treatment by the GWCTS, which reduces the amount of reagents used, wastes produced, and water discharged to the Menominee River.

4.5.4.3 Proposed Modifications

No modifications are proposed for the phyto-pumping system; however, Tyco continues to look for opportunities to augment/supplement the phyto-pumping system where appropriate.

4.6 Pump Down Program

In accordance with the AOR and as documented in the BWGMPU, the primary objective of the PDP is to reduce and maintain groundwater elevations in the former Salt Vault and 8th Street Slip areas (commonly referred to as the former Salt Vault and 8th Street Slip cells) to at or below the ordinary low water mark datum of 577.5 feet IGLD 1985 above mean sea level. It is important to note that the IGLD 1985 survey elevation of 577.5 feet in the river is equivalent to 577.9 feet using the North American Vertical Datum 1988 on land. Additional details on requirements for the PDP activities are outlined in the 2015 BWGMPU (CH2M 2015a). According to the AOR, the target elevation was to be achieved and maintained by December 31, 2017, unless it was determined that the target cannot be attained due to technical impracticability. Although achievement of the target elevation was not required until December 31, 2017, limited information was available on the technical feasibility of obtaining and maintaining the target elevation; therefore, Tyco elected to initiate the PDP program in 2016 to obtain the necessary information and allow for an extended period of pumping should achievement of the target elevation prove difficult.

4.6.1 Operations

Tyco conducted initial operation of the PDP in 2016 using a temporary extraction system; details were provided in the 2016 annual report (Tyco 2017a). In general, the temporary extraction system installed to achieve the target elevation consists of 1-inch-diameter high-density polyethylene hose that is inserted into each of the six temporary extraction wells within the designated pump down area. The high-density polyethylene conveyance line for each temporary extraction well is housed inside a 2-inch-diameter polyvinyl chloride pipe that serves as secondary containment for the conveyance line. Each conveyance line is connected to a hose pump capable of pumping approximately 3.8 gpm. Recovered groundwater is pumped through a well-dedicated totalizing flowmeter into one of four 10,000-gallon aboveground storage tanks installed within a temporary secondary containment system. The groundwater contained is transferred to tanker trucks for offsite disposal. Specific details of the temporary system were provided in the *Dewatering System Construction Report* submitted to the agencies in July 6, 2016 (Tyco 2016g).

Operational testing was performed in 2017 to evaluate the use of the existing treatment system to treat PDP groundwater. Planning with the agencies and preparation and approval of an operation testing procedure resulted in a limited timeframe for PDP pumping in 2017. In addition, pumping was negatively impacted because of limited or no availability of transport and disposal vendors to dispose of the groundwater offsite. Therefore, the target elevation was not able to be achieved and maintained in 2017. Based on the testing, it was determined that the existing GWCTS was not capable of adequately recovering the volume of groundwater necessary to reach and maintain the target elevations in the pump down area, and the groundwater treatment system also was not capable of adequately treating the groundwater to the criteria required for discharge to the river under the existing WPDES permit. Details of the 2017 pump down activities were provided in the 2017 annual report (Tyco 2018d).

Alternatives for achieving the target elevation in 2018 and beyond were evaluated in consultation with the agencies. Based on discussions, the temporary groundwater recovery and disposal system used since 2016 recommenced pumping in April 2018 while the permanent system could be designed, approved, and constructed.

The temporary groundwater recovery system was reinstalled in late March and early April 2018. Groundwater elevation data were collected from the prescribed monitoring well network before commencing extraction operations to provide a baseline reference for comparison during the 2018 pump down operations. Baseline groundwater elevation data were collected on April 19, 2018, and pump down operations recommenced on the same day, following these measurements. Baseline groundwater elevations in the former Salt Vault and former 8th Street Slip averaged 582.92 and 581.30 feet above mean sea level (or 5.02 and 3.40 feet above the target level), respectively. The initial extraction rate in the former Salt Vault was 12.12 gpm using the four extraction wells (EW-10, EW-11, EW-13, and EW-14) previously employed during the 2016-2017 PDP operations. The initial extraction rate in the former 8th Street Slip was 7.86 gpm using the two extraction wells (EW-8 and EW-9) previously employed during the 2016-2017 PDP operations.

Recovered groundwater was regularly transported offsite and disposed at the Waste Management Vickery Deepwell Hazardous Waste disposal facility in Vickery, Ohio, with the recovered groundwater removed from the facility by November 8, 2018. The temporary extraction system was decommissioned for the 2018 operational period during the week of November 5, 2018.

4.6.2 Performance

PDP system performance from 2016 through 2018 is summarized below:

- 2016 operations commenced on June 23, 2016 and ceased on October 24, 2016. Target elevations were met in both the former Salt Vault and former 8th Street Slip on June 29 and July 27, 2016, respectively (based on the average groundwater elevations of the applicable S and M monitoring wells). Limited operational testing was completed in 2016, consisting of periodic shutdown of some or all of the extraction wells in each cell to assess temporary system extraction efficiencies and the ability of the system to maintain the target elevation. Approximately 1,049,870 gallons[3] of groundwater were removed from the pump down areas during the operational period. Approximately 826,786 gallons of recovered groundwater were transported offsite for disposal at Waste Management's Vickery facility. The remaining 223,084 gallons were treated through the GWCTS.
- During 2016 to 2017 interim shutdown period, groundwater levels were monitored monthly within each cell. Based on the data collected during the interim shutdown period, groundwater elevations rose within each cell to average elevations above the target elevation, providing evidence that continued extraction would remain necessary in the cells.
- 2017 system operations commenced on August 29, 2017 and ceased on October 9, 2017. Because of limited availability to use the offsite groundwater disposal facility (Vickery), limited storage capacity, and results from the groundwater treatment system testing indicating PDP groundwater extraction and treatment at the current GWCTS was limited, pumping was conducted intermittently, and the

[3] The volume treated and disposed includes stormwater collected within the secondary containment structure during the pump down operating period. The volume of stormwater collected was not separately determined or documented.

target elevation was not reached during the limited operational period (Tyco 2017a). Approximately 118,417 gallons of groundwater were recovered, with 85,549 gallons disposed offsite and the remaining 32,868 gallons treated through the onsite groundwater treatment system as part of the system testing program.

- 2018 system operations commenced on April 19, 2018 and ceased on November 5, 2018. The target elevation was reached in both areas on June 8, 2018 (based on the average groundwater elevation of the applicable S and M monitoring wells). In general, groundwater elevations in the former 8th Street Slip continued to be lowered throughout the 2018 operations, with a final recorded average groundwater elevation of 573.83 feet above mean sea level (or 4.07 feet below the target elevation) on November 5, 2018. Continued groundwater elevation reduction in the former Salt Vault proved to be more challenging, with average elevations generally maintained around the target elevation throughout the remainder of the 2018 pumping operations. To improve recovery rates in the former Salt Vault with the intent of achieving and maintaining the target elevation, Tyco elected to perform extraction well cleanout activities on extraction wells EW-13 and EW-14. The cleanout activities were conducted during the week of September 19, 2018; however, improvement of the groundwater recovery rates from the two extraction wells was not observed. Groundwater elevation data obtained during the PDP period (June 2016 through early November 2018) are provided in Table 14. Figures 7A, 7B, and 14 present hydrographs of the 2018 groundwater elevation data for the former Salt Vault, former 8th Street Slip, and background wells, respectively.
- The extraction of groundwater from the PDP area ceased on November 5, 2018 in preparation for the winter shutdown period. Final groundwater extraction rates in the former Salt Vault and former 8th Street Slip were 2.92 gpm and 3.28 gpm, respectively. At the end of 2018 operations, the final average groundwater elevation in former Salt Vault was 578.19 feet (or 0.29 feet above the target elevation). Groundwater levels in the former 8th Street Slip were lowered to a final average groundwater elevation of 573.83 feet (4.07 feet below the target elevation). Figure 15 provides well drawdown information for each area based on individual water level measurements and an interpretation of area drawdown of the shallow wells. The volume of groundwater recovered during the 2018 PDP operations was approximately 1,293,000 gallons.

4.6.3 Conclusions and Current Status

Continued long-term extraction of groundwater within the former 8th Street Slip appears to be viable based on achieving the target elevation in the 2016 and 2018 operational periods. However, 2018 operations provided evidence that achieving and maintaining the target elevation in the former Salt Vault may be more challenging as demonstrated by the inability of the temporary extraction system operation to consistently maintain the target elevation.

Tyco continues to evaluate final management of the extracted PDP groundwater. While current operation of the temporary extraction system is dependent on offsite disposal of the recovered groundwater, it has proven to be an unreliable option as demonstrated by the limited ability/inability to dispose of recovered groundwater in 2017. Tyco has evaluated numerous alternatives for managing extracted groundwater from the PDP area. The permanent extracted groundwater management approach is dependent on the outcome of the WPDES variance request that is under review and discussion with the agencies.

Tyco has completed the design of a permanent extraction and conveyance system for groundwater recovered from the PDP area. The design has been approved by the agencies and the contractor procured for planned implementation of the design components in 2019. In general, each existing temporary extraction well in the PDP area will be converted to permanent wells and connected via underground piping to a newly constructed pumphouse to be located within the former Salt Vault area. An aboveground conveyance line will then transfer the recovered PDP groundwater to the existing groundwater treatment system building for storage and ultimate offsite disposal or possible future treatment.

Because of the results of the 2018 extraction activities in the former Salt Vault, it is proposed that two additional permanent extraction wells be installed in the former Salt Vault area to augment extraction capabilities. Details of the location and conveyance system design modifications are being developed.

Because of the pending status of the WPDES permit, the permanent extracted groundwater management approach is unknown at this time.

4.7 Estimation of Seepage at the Main Plant Barrier Wall

The AOR required a calculation that estimated the potential amount of groundwater migration from the Main Plant area that would affect the ability of the river sediment to maintain the 20 mg/kg remedial action objective for arsenic in river sediments. In July 2014, Tyco submitted the requested information to USEPA in the *Supplemental Evaluation: Potential for Recontamination of Menominee River Sediments due to Groundwater Migration from the Main Plant Area—Tyco Fire Products LP Facility, Marinette, Wisconsin* technical memorandum (CH2M 2014h). Based on comments from the agencies (USEPA 2014d), the supplemental evaluation subsequently was revised and resubmitted to the agencies on April 22, 2015 (CH2M 2015f). The evaluation followed a step-wise approach to estimate the volume of groundwater from the Main Plant area that could potentially recontaminate the river sediments. The steps included:

- Determine a weighted average arsenic concentration in groundwater within the containment area along the shoreline in the Main Plant.
- Estimate the annual arsenic mass loading required for sediment to reach 20 mg/kg after 10 years and after 100 years.
- Calculate the annual volume of groundwater discharge across or below the vertical barrier wall that would be needed to generate the arsenic mass loadings calculated in the step above.
- Provide context to the groundwater volume by calculating the hydraulic conductivity (K) value (leakage parameter) that would need to be exhibited by the vertical barrier wall, either as a result of seepage through the wall or flow from beneath the toe of the wall, to achieve these amounts of annual groundwater discharge. These K values were then compared to those assumed by the site groundwater model for the vertical barrier wall.

Based on the evaluation, the estimated annual arsenic load needed to reach 20 mg/kg after 10 years is estimated at 9.29×10^7 milligrams per year (mg/yr) arsenic (or approximately 205 pounds per year). Assuming the arsenic loading is coming through or under the wall (that is the top 33 feet of saturated thickness), the barrier wall theoretically would have to exhibit a K value of 6.32×10^{-4} feet per day (ft/day) to achieve this mass loading, which is approximately 23 times higher (that is, more groundwater flow through the wall) than the model-calibrated K-value for the barrier wall. To reach 20 mg/kg at 100 years, the annual loading of arsenic would have to be 6.03×10^7 mg/yr, which would correspond to a K value for the barrier wall of 4.1×10^{-4} ft/day, which is approximately 15 times higher than the model-calibrated K value for the barrier wall.

For comparison, the K value used for previous modeling of the barrier walls resulted in a calibrated value of K for the of 2.8×10^{-5} ft/day, an approximate factor of 25 lower than the K required to reach 20 mg/kg in 10 years and approximately 18 times lower than the K required to reach 20 mg/kg in 100 years. Note that because of the limited availability of actual field data, this evaluation was based on conservative assumptions and could be refined in the future as additional data become available that would improve the calculations.

4.8 Main Plant Barrier Wall Dye Testing

The performance of a dye test to assess the barrier wall effectiveness along the Menominee River was prescribed in the AOR and subsequently described in the BWGMPU (CH2M 2015a). As presented in the BWGMPU, the dye testing was to be completed following completion of a stormwater outfall investigation and potential repair/modifications to the stormwater system.

Before starting work on the full-scale dye test, WDNR requested potential Rhodamine WT dye concentrations be refined under a worst-case barrier wall seepage situation in an email correspondence on April 24, 2017 (WDNR 2017). Tyco provided the requested information in an email on May 16, 2017 (Tyco 2017f) and agreed to conduct the pilot dye test during a May 23, 2017 conference call with USEPA and WDNR. Tyco submitted a work plan to the agencies on August 14, 2017 (CH2M 2017a), which was

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modified based on agency comments (USEPA 2017a) that were documented in a letter (Tyco 2017g) and the work plan approved in an email by USEPA on September 8, 2017 (USEPA 2017b).

The primary objectives of the pilot dye test included:

- Quantitatively and qualitatively assessing dispersion and dilution of the Rhodamine WT in the Menominee River
- Assessing the suitability of the proposed fluorometers for measuring dye concentrations
- Assessing river background fluorescence
- Assessing river flow dynamics along the barrier wall
- Modeling Rhodamine WT dye dispersion
- Using data collected to refine full-scale dye test design
- Developing a technical report that summarizes the data collected, modeling, and any proposed changes to the full-scale dye test approach

The pilot dye test was conducted between September 18 and September 22, 2017. The results of the pilot test were submitted to the agencies on November 17, 2017 (CH2M 2017b). Because of the technical nature of the pilot dye test findings, a meeting was conducted between Tyco and the agencies on December 20, 2017 to discuss the results and potential path forward on the dye testing activities. During the meeting, and a subsequent meeting on February 14, 2018, it was concluded implementing a full-scale dye test to assess the barrier wall effectiveness would likely be unsuccessful; therefore, alternative approaches to dye testing were discussed. The alternatives presented for further consideration included:

- Surface water sampling for arsenic concentrations
- Natural tracer or isotope surface water sampling
- Geophysical survey
- Temperature differential survey
- Pore water investigation
- Temporary coffer dam installation
- Video or diver inspection

Based on an evaluation of the alternatives, it was agreed that Tyco would move forward with evaluating the use of passive on-wall and river bottom sampling using diffusive gradient in thin-film (DGT) samplers to be conducted along the Main Plant barrier wall along the riverfront. To complete the evaluation, Tyco proposed a pilot test using the DGT samplers coupled with surface water sampling. The pilot test was presented to the agencies in the *Passive Arsenic Sampling Pilot Test Work Plan and Alternatives Evaluation* on March 30, 2018 (CH2M 2018). The work plan and response to agency comments received in an email on April 26, 2018 (USEPA 2018a) were discussed during a May 16, 2018 project meeting between Tyco and the agencies. While no conclusions regarding the path forward on the DGT sampling approach were arrived at during the meeting, discussion of alternatives to the DGT approach were discussed that included establishing an enhanced monitoring well network along the riverfront in the Main Plant area. Tyco agreed to investigate the potential for establishing the enhanced monitoring well network. Subsequently, USEPA prepared a correspondence disapproving the DGT work plan and directing Tyco to continue with its evaluation of the enhanced monitoring well network (USEPA 2018b).

A June 26, 2018 conference call was conducted to confirm the objectives of an enhanced monitoring well network. The conference call also established necessary information to confirm the approach and implementation for the enhanced monitoring well network. The information on the establishment of an enhanced monitoring well network was presented to the agencies during an August 1, 2018 conference call. In response to the information presented during the conference call, the agencies provided comments in an email on September 4, 2018 (USEPA 2018c). The comments were subsequently addressed and presented to the agencies during an October 22, 2018 meeting.

Based on the October 22, 2018 meeting discussion, an addendum to the BWGMPU will be prepared that includes details on the enhanced monitoring well network, including installing five additional shallow monitoring wells, selecting a network of monitoring wells for continuous monitoring and subsequent evaluation using USGS SeriesSEE modeling to assess the barrier wall for potential leaks, and approaches for managing apparent leaks. The addendum also is to include development of other lines of evidence that the wall is performing as designed such as an underwater visual survey of the Main Plant barrier wall above the mudline in the river. The addendum is to be developed in 2019 with implementation anticipated in 2019.

4.9 Sediment Sampling 2018

In accordance with the AOR and using the procedures described in the BWGMPU, Tyco completed sediment monitoring activities in the Menominee River in 2018. Activities included collecting accumulated soft sediment samples to determine if they contained arsenic concentrations exceeding the 20 mg/kg cleanup goal. The sampling activities were conducted between July 8 and July 11, 2018 by Affiliated Resources LLC. Affiliated Resources' vibracore vessel consisted of a 20-foot pontoon boat with a 15-foot vertical triframe hoist and Rossfelder P-3 underwater vibracore system outfitted with 8-foot-long, 3-inch-diameter polycarbonate cores. Activities and results are summarized in the *Sediment Monitoring Report* submitted on September 28, 2018 (Jacobs 2018).

The sampling rationale was to collect a sample with 70% recovery from the predetermined sampling location by "sampling to refusal." If 70% recovery was not achieved after two attempts, a third attempt with a Ponar surface grab sampler was to be deployed to collect a surface sediment sample. If the Ponar surface grab sample yielded no recovery, the vessel was repositioned to an offset location within 70 feet of the initial sample for a second attempt as described above. If the offset location yielded no recovery, the sample location was eliminated.

Eighteen sampling locations were proposed for soft sediment sampling (Figure 13) with the following sample collection results:

- Two locations (SD-12 and SD-17) had a soft sediment thickness recovered in the core during the first attempt and the sample was collected from the core.
- Nine locations (SD-04, SD-08, SD-09, SD-10, SD-11, SD-13, SD-14, SD-15, and SD-16) had sediment thickness recovered in the core during the first attempt but required additional volume via Ponar to obtain enough sample for analytical testing.
- Two locations had no core recovery (SD-06 and SD-18), but a sample was collected via Ponar.
- Two locations (SD-02 and SD-03) had core recovery on the first attempt; however, no accumulated sediment was present in the core to sample, and no samples were submitted for analytical testing.
- Three locations (SD-01, SD-05, and SD-07) yielded no recovery after two vibracore attempts and one subsequent Ponar attempt at the initial proposed sampling location. Offset locations (identified as "B" in their respective sample identifications) were then attempted, and recovery was obtained. Two of these locations had sediment present that was sampled (SD-05B via the core and SD-07B via Ponar), and one (SD-01B) had no sediment thickness to sample and no sample was submitted for analytical testing.

Field data (for example, as-sampled coordinates, water elevation, water depths, and sediment thickness) are summarized in Table 15. Samples collected for total arsenic from the soft sediment layer, if present, were scheduled for immediate laboratory analysis, subsequent total arsenic samples collected from underlying stratigraphic layers other than soft sediment were sent to the laboratory "on hold." A USEPA representative collected several samples from the cores/Ponar grab samples, which were submitted to a laboratory for total arsenic analysis. USEPA samples included five soft sediment sample splits, eight sand cover samples, and five native material samples for analysis. The USEPA results were provided to Tyco in the form of a summary spreadsheet in an email correspondence on September 19, 2018 (USEPA 2018d). The USEPA results are discussed below, although these data were not able to be quality reviewed by Tyco since the laboratory reports were not included. To provide context for the initial soft sediment sample results and confirm USEPA sample results, Tyco requested total arsenic analysis of one sand cover and eight native materials samples that had been placed "on hold" for total arsenic analysis.

Soft sediment thicknesses measured in the field ranged from 0 to 1 foot (Figure 16). Most locations had soft sediment thicknesses of 0.5 foot or less with only two locations greater than 0.5 foot. Estimated sedimentation rates based on the observed sediment thicknesses range from 0 to 3 inches per year (Table 15). Arsenic concentrations in soft sediments ranged from 1.7 to 380 mg/kg (Figure 13). Five locations (SD-05B, SD-06, SD-09, SD-11, and SD-18) exceeded the 20 mg/kg cleanup criteria. Table 15 summarizes the sediment thickness and total arsenic results. Figures 13 and 16 present the arsenic in sediment and sediment thickness results, respectively.

Sediment concentrations and thicknesses should continue to be monitored (as part of the 2023 five-year review sampling) to evaluate sediment deposition rates and arsenic concentrations. A preliminary evaluation of the 2018 sediment sampling results and mechanisms that may be resulting in the observed exceedances of the 20 mg/kg criteria are provided in Appendix E. A pore water work plan is being developed per the request of the agencies. It is anticipated the data generated from these activities will allow for further evaluation of potential sediment recontamination mechanisms.

4.10 Revised 2013 Five Year Review

Pursuant to the requirement in the AOR, Tyco provided a final revised addendum to the *2013 Five Year Technical Review* document on July 23, 2014 (CH2M 2014a), which also responded to USEPA comments provided in correspondence dated February 3, 2014 (comments only) and July 2, 2014 (approval with modifications) (USEPA 2014e, 2014f). In accordance with the AOR, proposed modifications to the remedy and the new actions to be implemented, as indicated in the AOR and in accordance with paragraph 11.g of the AOC, were described.

4.11 Outfall Investigations and Repairs

At the request of USEPA, a sampling plan was developed and submitted to USEPA under the technical memorandum *Outfall Arsenic Investigation* (CH2M 2015c), documenting sampling locations and procedures for assessing the arsenic quality in the stormwater discharging from the site. It is important to note that the investigation focused solely on stormwater discharge, not industrial processes discharge. USEPA comments were received in the document *Tyco Outfall Arsenic Investigation Technical Memorandum Agency Review Comments*, dated February 20, 2015 (USEPA 2015b). Agency comments were addressed, and the sampling plan was resubmitted to USEPA in the March 23, 2015 technical memorandum *Responses to February 23, 2015 EPA Comments on "Tyco Fire Products Outfall Arsenic Investigation Technical Memorandum" dated February 3, 2015* (CH2M 2015g). Final approval of the plan was received in a correspondence from USEPA dated April 16, 2015 (USEPA 2015c).

The first of two planned sampling events was completed on May 7, 2015, followed by a second sampling event on August 28, 2015. The results of the sampling events were summarized in the technical memorandum *Outfall Arsenic Investigation: Spring and Summer 2015 Sampling Event Summary* (CH2M 2015h). Based on the investigation results, Tyco developed a plan for upgrades/modifications to the stormwater system, which was presented to USEPA in the *Stanton Street Stormwater Improvement Plan* (AECOM 2016), and attached to Tyco's responses to USEPA comments on the *Outfall Arsenic Investigation Report* (Tyco 2016h). Comments to the stormwater improvement plan were received from the agency on October 17, 2016 (USEPA 2016c), with response to the comments provided by Tyco on November 11, 2016 (Tyco 2016i). The plan included video survey of select stormwater lines, implementation of necessary repairs and CIP lining, abandonment of select underground stormwater lines, and replacement of select underground stormwater lines with aboveground stormwater drainage.

In 2016, Tyco initiated upgrades/modifications to the industrial process water/stormwater conveyance system. The industrial line discharge (WPDES Outfall #001) includes treated industrial process water, non-contact cooling water, boiler house condensate, and a portion of the site stormwater. The work was to reduce the potential for arsenic-impacted groundwater from entering the system and ultimately discharging to the Menominee River through the WPDES outfall. The upgrades included CIP lining of components of the industrial line, CIP lining of associated stormwater lines that were to remain operational, and abandonment of components of the industrial/stormwater lines that were no longer needed.

In 2017, Tyco initiated upgrades/modifications to the remaining stormwater system at the facility. Initial activities included the video surveying of the underground stormwater lines on the property to assess the integrity of the lines and develop a plan for implementation of necessary repairs. For underground lines no longer necessary, grout was pumped into the lines or catch basins to eliminate the collection and ultimate discharge of stormwater through these abandoned components. For stormwater lines that were to remain active, CIP ling was conducted where necessary including at catch basin/manholes. It should be noted that CIP lining was not necessary for the underground stormwater lines associated with Outfall #2 and Outfall #10 because of the type of line construction or newness (Outfall #10 installed in 2010) of the lines.

The subsurface components of Outfall #3, located near Building 71, were abandoned, and the surface area was contoured to direct overland flow of stormwater over the barrier wall to avoid potential groundwater contact with the stormwater. In addition, the subsurface components associated with Outfalls #5 and #6 also were abandoned. These areas also were contoured and modified to allow direct overland flow stormwater discharge. As a component of the Outfall #6 modification, a gate valve was installed to allow for separation of stormwater collected on the former Salt Vault that may come in contact with impacted soils or groundwater during potential future remedial actions that may occur in the area. Final CIP lining and installation of the gate valve were completed in 2018.

As of October 2018, only six of the locations previously sampled as part of the outfall investigation remain. The following sample locations have been abandoned as part of the system upgrades/modifications:

- MH305 – located in the northwestern portion of the site. Manhole and associated stormwater line were abandoned in 2016.
- CB298 – located west of Building 71. Catch basin and associated underground stormwater line including Outfall #3 were abandoned in 2017. Stormwater is now conveyed via overland flow over the barrier wall.
- MH323 – located north of Building 18. The manhole was abandoned and associated underground conveyance line disconnected from the stormwater system
- CB406 - located near the southwestern corner of the former Salt Vault in the ChemDesign lease area. The catch basin was abandoned. No outfall or stormwater collection system exists associated with the underground line.
- CB297 – located in the former Salt Vault. The catch basin and associated underground conveyance line to Outfall #6 has been abandoned. The area, along with Outfall #5, has been converted to a surface drainage system with overland flow from the area being diverted over the barrier wall.

Samples were collected at five of the six remaining designated stormwater sampling locations at the facility. The sixth location, CB231, located near the northwestern corner of Building 29 was not sampled during the October 2018 sampling event because final repairs to the underground conveyance system had not been completed. Figure 3 presents the laboratory analytical results for the outfall sampling events to date. Based on the sampling efforts conducted, concentrations of arsenic remain in the stormwater following upgrade/modification activities. However, some of the areas that historically (based on pre-upgrade sampling in 2015) had elevated arsenic concentrations have been abandoned, thus eliminating the potential source of arsenic for discharge to the river. In addition, arsenic concentrations at the location of catch basin B71 decreased an order of magnitude following the upgrade/modification activities. The remaining limited dataset (some locations only have one sample from the three sampling events) does not allow for conclusions to be drawn regarding long-term arsenic concentrations in the stormwater system at this time. In accordance with the agreement with USEPA, additional outfall sampling activities are to be conducted in 2023 and 2028.

5. Review of Arsenic and the Protection of Human Health and the Environment for Groundwater

This section provides an evaluation of the current scientific and engineering knowledge relevant to protecting human health and the environment for arsenic in groundwater per Section VI, 11, paragraph g of the AOC (USEPA 2009a). Baseline ecological and human health risk assessments were submitted to USEPA in February 2003 (URS 2003a). The risk assessments identified arsenic as the only chemical of potential concern resulting in unacceptable risk for one or more receptors and exposure pathways. The risk assessments for groundwater indicated the potential for noncancer risks to future onsite construction workers above USEPA-acceptable levels.

Site groundwater has not been used as a drinking water source, and future use as a drinking water source is not anticipated; therefore, potable use of groundwater was not evaluated in the risk assessment (URS 2003a). Pursuant to the AOC, an institutional control (as part of the deed restriction) has been implemented at the site preventing potable use of site groundwater and the barrier wall installed at the site prevents offsite migration of contaminated groundwater. In 2018, there remains no potable use of onsite or offsite impacted groundwater; therefore, potable use of site groundwater remains an incomplete pathway.

The only potentially complete human health exposure pathway for groundwater identified in the risk assessment was incidental ingestion and dermal contact by construction workers during future excavation activities. Potential exposure to arsenic-contaminated groundwater by construction workers was quantified in the risk assessment (URS 2003a).

The arsenic toxicity values used in the 2003 risk assessment for oral and dermal exposures were an oral slope factor of 1.5 mg/kg-day^{-1} and an oral reference dose of 3×10^{-4} mg/kg-day (URS 2003a). As presented in USEPA's Integrated Risk Information System database, the oral and dermal toxicity values for arsenic are the same as those used in the 2003 human health risk assessment (USEPA 2018e).

Based on the exposure scenario assumptions identified above, the following risk and hazard estimates were calculated for construction worker contact with groundwater:

- An excess lifetime cancer risk of 4×10^{-5}
- A noncancer hazard index of 6

The groundwater exposure assumptions used in the 2003 risk assessment, although conservative, remain valid since no default construction worker exposure assumptions are available from USEPA guidance and other sources for quantifying groundwater contact scenarios (for example, contact rate, frequency, and duration). As stated in Section 11.4.3 of the 2003 risk assessment (URS 2003a), "Professional judgment was used to estimate ingestion and dermal exposure to groundwater, because no guidance was available regarding these types of exposures in a trench or foundation. There is large uncertainty associated with the hazard/risk estimates for the future construction worker due to the large uncertainty related to the extent of potential future groundwater exposures in a trench or foundation at the site."

Tyco uses a health and safety plan that requires appropriate personal protective equipment, internal notifications prior to excavation, and management of material according to the regulations to prevent contact with groundwater. In addition, institutional controls and security have been put in place as indicated above and in Sections 4.1 and 4.3, respectively, which also prevents contact with groundwater.

A quantitative remedial action objective (that is, cleanup level) was not established for arsenic in groundwater; therefore, there was no quantitative cleanup level to evaluate for arsenic. For reference, the project has compared groundwater concentrations to available regulatory criteria for comparison purposes. The MCL prior to 2002 was 50 µg/L; in 2002, the arsenic MCL changed from 50 to 10 µg/L. The corrective measures study (CMS) was completed in 2003 (URS 2003b) using the PAL (5.0 µg/L) and ES (50 µg/L) for arsenic in groundwater, as established by WDNR. The Statement of Basis was developed in 2007 using the PAL of 1 µg/L and ES of 10 µg/L for groundwater (USEPA 2007). As of December 1, 2018, the ES (10 µg/L) and PAL (1 µg/L) remain the same as those in the Statement of Basis.

In reviewing the current scientific and engineering knowledge relevant to protecting human health and the environment for arsenic in groundwater, it has been determined that the findings in the 2003 risk assessment have not changed, and that the only potential exposure to arsenic contaminated groundwater is by construction workers, but is controlled at the site through the Tyco health and safety plan, institutional controls, and site security.

6. Review of Arsenic Treatment Technologies for Groundwater

This section provides a review of treatment technologies for remediating arsenic in groundwater that have been developed or advanced since the *2013 Five Year Technical Review* (CH2M 2013b, 2014a). Since science and technology are constantly changing and improving, the objective is to conduct a review to identify any newly available arsenic treatment technologies or advances and assess the potential for application at the site. The following subsections summarize the previous technology reviews as well as provide a discussion of the site characteristics that control the selection and screening of groundwater treatment technology options.

6.1 Historical Treatment Technology Reviews

The CMS report (URS 2003b) and Addendum 01 to the CMS (Earth Tech, Inc. 2007) evaluated several treatment technologies to identify potential corrective actions alternatives that would protect human health and the environment and prevent offsite contaminant migration. A summary of the groundwater, soil (since treating soil can help groundwater), and groundwater/soil remedial technology screening presented in the CMS report and the associated addendum is provided below.

- **Groundwater Technologies** – For groundwater alone, the technologies listed below were screened as potential remedial options, but only the permeable reactive barrier (PRB; in ***bold italics***) was selected for further evaluation. The other technologies were not evaluated further because of the limitations of groundwater extraction at the site and/or contaminant limitations (such as high contaminant concentrations, chloride/organics present, chemical species characteristics). A traditional groundwater pump and treat system was attempted as an interim action in the 1980s and was ineffective, as groundwater extraction had become inefficient and extraction was technically impracticable due to the low permeability in the deeper fine-grained soils/silt layer (Earth Tech, Inc. 2007).
  - Adsorption
  - Coagulation, Flocculation, and Precipitation/Co-Precipitation
  - Evaporation and Filtration/Ultrafiltration
  - Immobilized Algae
  - Ion Exchange
  - ***Permeable Reactive Barrier***
  - Reverse Osmosis
- **Soil Technologies** – The following technologies for addressing soil (which may also help with groundwater in some instances) were screened as options but only the ***bold italics*** options were selected to be further evaluated in the CMS.
  - ***Cap***
  - Excavation and Landfill Disposal
  - Pyrometallurgical Recovery
  - Soil Flushing
  - Soil Washing/Acid Extraction
  - Steam Stripping
  - Vacuum Extraction
  - Vitrification
  - ***Institutional Controls***
- **Soil and Groundwater Technologies** – The following technologies for addressing both the soil and groundwater were screened as options but only the ***bold italics*** options were selected to be further evaluated in the CMS.
  - Air or Ozone Injection
  - Biological Treatment
  - ***Containment***

- Electrokinetics
- ***In-situ stabilization***
- Incineration
- Monitored Natural Recovery
- ***Phytoremediation***
- Steam Stripping
- Thermal Desorption

Technologies were then combined where necessary and appropriate to address all impacted media. Technologies that satisfied the screening criteria outlined in the CMS include:

- Cap and contain
- PRB
- Cap and contain with hydraulic control
- PRB and phytoremediation
- In-situ stabilization

In the CMS, the PRB was the selected remedy that best mitigated the threat to human health and the environment posed by the subsurface contamination at the site. Later bench-scale treatability studies indicated that a PRB would not be effective at the site full scale (Earth Tech, Inc. 2007). The selected onsite corrective action alternative in the CMS Addendum 1 was to cap and contain groundwater with hydraulic control; the CMS report contains further details (URS 2003b). Ultimately, the final USEPA-approved remedy is described in Section 1.5 of this report and detailed in the AOC and Attachment 1 of the AOC (the USEPA Final Decision and Response to Comments document, USEPA 2009a). The final remedy for groundwater included institutional controls, a containment barrier, and an onsite GWCTS to maintain groundwater levels to prevent onsite flooding. The AOC was finalized in February 2009 and accounted for technological advances since the 2007 review.

6.2 Site and Contaminant Characteristics Controlling Technology Applicability

The site and contaminant characteristics are the main factors that limit or promote use of certain technologies. The major contributing site and contaminant characteristics that drive selection of technology options for the site are:

- Pervasive nature of highly elevated and predominantly organic forms of arsenic in groundwater that make the site unique
- Presence of active manufacturing operations at the site
- Low hydraulic conductivity of soils in areas with the most heavily contaminated groundwater (groundwater in deeper, lower hydraulic conductivity stratigraphic units, tends to have higher arsenic concentrations than shallower groundwater), which limits groundwater extraction capabilities
- Heterogeneity of soils
- High total dissolved solids/salinity in groundwater (variability in salinity of groundwater across the site)
- Arsenic is an element and cannot be further degraded

6.3 Current Arsenic Treatment Technology Review

The last major review of technologies for groundwater treatment at the site was in the *2013 Five Year Technical Review* (CH2M 2013b). The current technology review screening only considers organic arsenic remedial technologies that are new as of 2009 that were included in the 2013 review and any advances or updates in technologies since 2013. The technologies were evaluated for their ability to treat the specific forms of arsenic at the site. Technologies were then assessed to determine if they were appropriate to address impacted media at the site considering the geological and physical site characteristics. The results are summarized in Table 16.

No new treatment technologies for groundwater have been identified as part of this remedy review that would result in replacing or augmenting the current onsite groundwater remedy of containment. Some additional details on ex-situ groundwater treatment technology options are available and summarized in Table 16 as well; however, the limitations of groundwater extraction at the site have not changed, and although included, the ex-situ groundwater treatment technologies were not further evaluated for use at the site as part of this review and will be included as part of the WPDES permit variance process that is underway.

7. Summary

This report meets the requirements in the AOC for the five-year technical review and 2018 annual barrier wall groundwater monitoring report. All components of the AOC, AOR, and other remedy enhancements bulleted below have been implemented in accordance with the AOC/AOR, and their status is summarized in Section 4 and briefly summarized below.

- Institutional controls – Completed.
- Soil remediation – Completed, in long-term O&M.
- Menominee River sediment removal – Completed.
- Site security – Completed.
- Onsite groundwater management, which includes:
  - Containment barrier wall – Completed, in long-term O&M.
  - GWCTS – Completed, in long term O&M.
  - Phyto-pumping system – Completed, in long-term O&M.
  - Barrier monitoring – Completed, in long-term monitoring phase. Completed BWGMPU AOR requirement. Addendum to follow in 2019 to capture enhance monitoring network and underwater visual inspection along the Main Plant barrier wall.
- PDP – Ongoing.
- Estimation of seepage at the Main Plant barrier wall – Completed.
- Sediment sampling in 2018 and 2023 – 2018 completed, next event in 2023.
- Main Plant barrier wall dye testing – Enhanced monitoring network work and underwater visual inspection approach are being prepared in a BWGMPU addendum to replace the dye test requirement.
- Submit addendum to 2013 five-year review addressing USEPA comments – Completed.
- Outfall investigations and repairs – Repairs completed, 2015 and 2018 sampling completed, next event in 2023.

A more detailed evaluation of the onsite groundwater management component was required as part of the five-year technical review as indicated in the AOC. The performance to date of the three main technologies that comprise the onsite groundwater management system required in the AOC as well as each components appropriateness and any proposed modifications are evaluated in applicable subsections in Section 4.

Based on the review of current results and available information, the onsite groundwater management remedy components, as well as other the related AOR remedy components, are operating and performing as designed and meeting the need to contain groundwater onsite as further detailed in the following:

- Containment barrier wall – Performance monitoring data and wall inspections indicate the barrier wall is an effective hydraulic barrier for groundwater flow in the unconsolidated deposits and that arsenic in groundwater is not likely to serve as a continuing source of arsenic to the Menominee River.
- BWGMPU – No changes or corrective actions are needed as part of the barrier wall groundwater monitoring. It is recommended that semiannual sampling occur for 1 more year in 2019 and then the frequency for future events be evaluated as part of the 2019 annual report. An addendum to the BWGMPU will be prepared to include details of enhanced monitoring well network activities (to replace the dye test), which will be developed in early 2019 with implementation anticipated in 2019. The enhanced monitoring well network will include installing five additional water table (shallow) monitoring wells, installing and operating transducers at a selection of monitoring wells, evaluating

the transducer data using USGS SeriesSEE, and performing an underwater visual inspection in the Menominee River above the mudline along the Main Plant barrier wall.

- GWCTS – The system is generally operating as designed by maintaining the groundwater levels in the containment areas and preventing the facility from flooding. However, modifications and upgrades to the existing groundwater system may be implemented in the future to allow for onsite management of PDP groundwater and to work toward lowering overall effluent concentrations. The modifications would be based on the path forward decided on as part of the WPDES permit variance being evaluated by the agencies. Tyco is collecting additional information requested by the agencies related to the variance.
- Phyto-pumping system – The phyto-pumping system will continue to be used as part of the groundwater management strategy. The phyto-pumping system helps to reduce the volume of water requiring treatment by the GWCTS, which reduces the amount of reagents used, wastes produced, and water discharged to the Menominee River.
- PDP – The target elevation appears to be achievable and maintainable in the former 8th Street Slip using the existing extraction well network, based on 2016 to 2018 data. Due to the results of the 2018 extraction activities in the former Salt Vault and not being able to maintain the target elevation, it is proposed that two additional permanent extraction wells be installed in the former Salt Vault to augment extraction capabilities. Details of the location and conveyance system design modifications are being developed. Construction of the permeant conveyance system to allow pumping year-round is planned for 2019.
- Dye test – Based on the results of the pilot dye test, it has been concluded that performance of a full-scale dye test is not appropriate for implementation. The dye test component of the AOR is to be replaced with an enhanced monitoring well network to be established along the Main Plant riverfront and will be documented in an addendum to the BWGMPU.

A review of the current scientific and engineering knowledge relevant to protecting human health and the environment for arsenic in groundwater also was required. The review determined that the findings in the 2003 risk assessment (URS 2003a) have not changed and that the only potential exposure to arsenic contaminated groundwater is by construction worker, but is controlled at the site through the Tyco health and safety plan, institutional controls, and site security.

Finally, a review of current arsenic treatment technologies was required and completed. No new treatment technologies for groundwater have been identified that would result in replacing or augmenting the current onsite groundwater remedy of containment. Some additional ex-situ groundwater treatment technology options are available; however, the limitations of groundwater extraction at the site have not changed. The ex-situ groundwater treatment technologies are being further evaluated for use at the site as part of the WPDES permit variance process and not this review.

8. References

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Tables

Table 1. AOC Deliverable Summary

Tyco Fire Products LP, Marinette, Wisconsin

Description of Submittal	Submitted to	Date Submitted
Glacial Till Verification Activities, Menominee River Sediment Removal, Tyco Fire Products, Marinette, Wisconsin: Addendum Two (dated November 13, 2013)	USEPA	12/9/2013
Five Year Technical Review	USEPA	12/30/2013
Email - Notice of Drilling and potential well installation	USEPA	12/31/2013
Email - Notice of Drilling and potential well installation follow up (with figure and additional details)	USEPA	1/3/2014
Quarterly Progress Report	USEPA	1/14/2014
USEPA Review of Five Year Technical Review Report dated December 30, 2013	Tyco	2/3/2014
Construction Completion Report Menominee River Sediment Removal Project Adjacent to the Tyco Fire Products LP Facility Marinette, Wisconsin	USEPA	3/3/2014
Responses to USEPA Comments on "USEPA Review of Five Year Technical Review Report dated December 30, 2013"	USEPA	3/6/2014
USEPA Response to Tyco Letter Dated March 6, 2014, from CH2M HILL In Response to USEPA Letter dated February 3, 2014	Tyco	3/18/2018
Response to USEPA's March 12, 2014 Email Concerning the Follow-up to Barrier Wall Inspection Reports	USEPA	3/21/2014
Response to USEPA Letter Dated March 18, 2014 5 Year Review Report Comments	USEPA	4/2/2014
USEPA Review of Tyco Sediment Removal Construction Completion Report, CH2M HILL	Tyco	4/7/2014
Quarterly Progress Report	USEPA	4/15/2014
Agreement on Resolution of 2013 Five Year Technical Issues	Tyco	4/23/2014
Drilling Activities Technical Memorandum- Status Report for Test Well Installation Field Activities, January 21 to March 6, 2014	USEPA	5/1/2014
Response to USEPA Comments on "USEPA Review of Tyco Sediment Removal Construction Completion Report, CH2M HILL"	USEPA	5/7/2014
Addendum to the Five Year Technical Review Document dated December 30, 2013	USEPA	5/30/2014
USEPA Review of Tyco Revision to Construction Completion Report dated May 7, 2014	Tyco	6/3/2014
Response to USEPA Comments on the May 7, 2014 Tyco Revisions to the Construction Completion Report, dated March 2014	USEPA	6/24/2014
Vertical Barrier Wall Inspection Follow-Up	USEPA	6/30/2014
Barrier Wall Groundwater Monitoring Plan Update	USEPA	6/30/2014
USEPA Approval with Modifications: Five Year Technical Review Report dated December 30, 2013, and Addendum to Five Year Technical Review Report dated May 30, 2014	Tyco	7/2/2014
Quarterly Progress Report	USEPA	7/14/2014
Response to USEPA Comments on the July 2, 2014 Five Year Technical Review Report dated December 30, 2013 and Addendum to Five Year Technical Review Report dated May 30, 2014	USEPA	7/23/2014
Supplemental Evaluation: Potential for Recontamination of Menominee River Sediments due to Groundwater Migration – Tyco Fire Products LP Facility, Marinette, Wisconsin	USEPA	7/30/2014
Aquifer Testing Field Activities and Results: April and May 2014	USEPA	7/31/2014
Response to USEPA's September 5, 2014 Email Information Request – Outfalls and Dye Testing Radius of Influence	USEPA	9/26/2014
USEPA Comments and Request for Revision Tyco Barrier Wall Groundwater Monitoring Plan Update dated June 30, 2014	Tyco	10/10/2014
Quarterly Progress Report	USEPA	10/15/2014
USEPA Comments and Request for Revision Tyco Technical Memorandum Supplemental Evaluation: Potential for Recontamination of Menominee River Sediments due to Groundwater Migration from the Main Plan Area dated July 30, 2014	Tyco	10/30/2014
Quarterly Progress Report	USEPA	1/14/2015
Summary of the Discussions and Information Presented on the Question of Whether to Install Bedrock Monitoring Wells Outside Tyco's Vertical Barrier Wall	USEPA	2/2/2015
Outfall Arsenic Investigation	USEPA	2/3/2015
USEPA comments on Comments on "Tyco Fire Products Outfall Arsenic Investigation Technical Memorandum" dated February 3, 2015	Tyco	2/23/2015
Infiltration Reduction Plan	WDNR	3/3/2015
2014 Annual Barrier Wall Report	USEPA	
Updated Dye Injection Information and Estimates	USEPA	3/13/2015
Responses to February 23, 2015 USEPA Comments on "Tyco Fire Products Outfall Arsenic Investigation Technical Memorandum" dated February 3, 2015	USEPA	3/23/2015
Final Tyco Memorandum: Tyco Review of Additional USEPA Proposed Wells - Barrier Wall Groundwater Monitoring Program Update -March 31, 2015	USEPA	4/1/2015
Final Tyco Memorandum: Tyco's Proposed Additional Sediment Samples - Barrier Wall Groundwater Monitoring Program Update - March 31, 2015	USEPA	4/1/2015
Final Tyco Memorandum: Tyco's Response to Proposed WDNR Additional Parameters Request - Barrier Wall Groundwater Monitoring Program Update - March 31, 2015	USEPA	4/1/2015
Extension Request for Barrier Wall Groundwater Monitoring Plan Update	USEPA	4/9/2015
USEPA Approval of Extension Request Tyco Updated Barrier Wall Monitoring Plan	Tyco	4/14/2015
Quarterly Progress Report	USEPA	4/15/2015
USEPA Approval with Modifications and/or Conditions of Tyco Updated Outfall Arsenic Investigation, CH2M HILL Technical Memorandum dated March 23, 2015	Tyco	4/16/2015
USEPA Letter Re: Tyco Updated Dye Injection Information and Estimates Proposal CH2M HILL Technical Memorandum dated March 13, 2015	Tyco	4/16/2015
Agency 4/20/15 Edited Response to Tyco 3/31/15 Proposal on Monitoring Wells	Tyco	4/20/2015
Response to USEPA Comments on the July 30, 2014 Supplemental Evaluation: Potential for Recontamination of Menominee River Sediments due to Groundwater Migration from the Main Plant Area	USEPA	4/22/2015
Technical Memorandum: Updated Supplemental Evaluation: Potential for Recontamination of Menominee River Sediments due to Groundwater Migration from the Main Plant Area	USEPA	4/22/2015
Agency Edited Response to Tyco 03-31-15 Proposal on Additional Parameters Request - April 30, 2015	Tyco	4/30/2015
USEPA Approval of Tyco Technical Memorandum Updated Supplemental Evaluation: Potential for Recontamination of Menominee River Sediments due to Groundwater Migration from the Main Plant Area dated April 22, 2015	Tyco	6/26/2015
Response to April 16, 2015 USEPA Comments "Tyco Updated Dye Injection Information and Estimates Proposal CH2M HILL Technical Memorandum dated March 13, 2015"	USEPA	6/29/2015
Tyco's record letter on BWGMP Updates	USEPA	6/29/2015
Tyco Fire Products LP's Final Offer Regarding the Update to the 2010 Barrier Wall Groundwater Monitoring Plan Enclosures 1-Revised Barrier Wall Groundwater Monitoring Plan Update (June 29, 2015) 2-Revised Responses to October 10, 2014 USEPA Comments on Tyco Barrier Wall Groundwater Monitoring Plan Update (June 29, 2015) 3-History of Negotiations- Barrier Wall Groundwater Monitoring Plan Update (June 29, 2015)	USEPA	6/29/2015

Table 1. AOC Deliverable Summary

Tyco Fire Products LP, Marinette, Wisconsin

Description of Submittal	Submitted to	Date Submitted
Email Notification of Repairs of grout plug at vertical barrier wall joint	USEPA	7/7/2015
Quarterly Progress Report	USEPA	7/15/2015
Proposed Modifications to the Groundwater Collection and Treatment System	USEPA	7/22/2015
USEPA Approval and Modification Tyco Revised Barrier Wall Groundwater Monitoring Plan Update June 2015	Tyco	8/5/2015
Tyco Email - Responses to August 5, 2015 USEPA Letter Approval and Modification Comments Tyco Barrier Wall Groundwater Monitoring Plan Update June 2015	USEPA	8/11/2015
USEPA Email - Responses to Tyco-Requested Changes to USEPA Approval Clarifications to Monitoring Plan Update Letter Issued August 5, 2015	Tyco	8/14/2015
Final, Revision 2 - Revised Barrier Wall Groundwater Monitoring Plan Update	USEPA	9/3/2015
USEPA Approval Tyco Revised Barrier Wall Groundwater Monitoring Plan Update September 2015	Tyco	9/15/2015
USEPA Email - Response to July 22, 2015 Tyco GWCTS Upgrades Proposal	Tyco	9/21/2015
Monitoring Well Abandonment Exemption Request	WDNR	9/21/2015
Informational Submittal -Outfall Sampling Activities	USEPA	9/25/2015
WDNR Email - Response to Monitoring Well Abandonment Exemption Request	Tyco/CH2M	9/29/2015
2014 Barrier Wall Groundwater Monitoring Annual Report	USEPA	10/7/2015
Quarterly Progress Report	USEPA	10/15/2015
Barrier Wall Groundwater Monitoring Well Drilling Notification and Scope of Work	USEPA	10/15/2015
Outfall Arsenic Investigation: Spring and Summer 2015 Sampling Event Summary	USEPA	10/30/2015
USEPA 2014 Barrier Wall Groundwater Monitoring Annual Report October 2015 Observations	Tyco	11/6/2015
Final Sampling Summary Report, Great Lakes Legacy Act Lower Menominee River Tyco Site Adjacent to the Tyco Fire Products LP Facility	USEPA	11/12/2015
Report on Decontamination Measures Completed in Building 59	WDNR	11/17/2015
Tyco 2016 Cost Estimate	USEPA	11/23/2015
USEPA Approval of Tyco 2016 Cost Estimate	Tyco	12/8/2015
Response to November 6, 2015 USEPA Document USEPA 2014 Barrier Wall Groundwater Monitoring Annual Report October 2015 Observations	USEPA	12/11/2015
Proposed Groundwater Collection and Treatment System Enhancements - Description of Post-Modification Process Flow	WDNR	12/18/2015
Environmental Quality Management, Inc. - Final Remedial Action Completion Report, Great Lakes Legacy Act Lower Menominee River Tyco Site	USEPA-GLNPO	12/28/2015
Quarterly Progress Report	USEPA	1/15/2016
Addendum to Construction Completion Report, Menominee River Sediment Removal Project, Adjacent to the Tyco Fire Products LP Facility, Marinette, Wisconsin	USEPA	2/1/2016
USEPA Approval of Tyco Addendum to Construction Completion Report	Tyco	2/16/2016
Additional Information Request, Addendum to Construction Completion Report	USEPA	3/9/2016
USEPA Review of Tyco Outfall Investigation Report	Tyco	3/21/2016
WDNR Email - Questions Regarding Proposed Dye Testing	Tyco/CH2M	3/25/2016
Former Salt Vault and Former 8th Street Slip Pump Down Program Dewatering Services Scope of Work	USEPA	3/30/2016
Response to WDNR Questions Regarding Proposed Dye Testing	USEPA	4/15/2016
Collection of Surface Water Samples for Dye Testing Investigation	USEPA	3/30/2016
Subsurface Injection of Tracer Dye Scope of Work (Contractor Document)	USEPA	3/30/2016
Quarterly Progress Report	USEPA	4/15/2016
Extension Request - Response to Comments to USEPA Review of Tyco Outfall Investigation Report	USEPA	4/18/2016
Tyco Extension Request - Response to Comments to USEPA Review of Tyco Outfall Investigation Report	Tyco	5/3/2016
High Capacity Well Application	WDNR	5/23/2016
WDNR Email - Ansul/Tyco: Scopes of work for Pump Down Program and Dye Test Work	Tyco	6/6/2016
Tyco Pump Down Program Work Plan and HSERP	USEPA	6/10/2016
2015 Barrier Wall Groundwater Monitoring Annual Report	USEPA	6/22/2016
Well Installation, Abandonment, and Repair Field Activities, November 2 to December 2, 2015	USEPA	6/28/2016
Tyco Pump Down Program Work Plan and HSERP	USEPA	6/10/2016
Dewatering System Construction Report	WDNR	7/2/2016
Quarterly Progress Report	USEPA	7/15/2016
Extension Request - Response to Comments to USEPA Review of Tyco Outfall Investigation Report	USEPA	8/2/2016
Responses to USEPA Review of Tyco Outfall Investigation Report	USEPA	9/8/2016
Quarterly Progress Report	USEPA	10/14/2016
Response to Comment to Stormwater Improvement Plan	USEPA	11/4/2016
2017 Cost Estimate	USEPA	12/2/2016
Temporary Dewatering Well Water Withdrawal Report	WDNR	1/12/2017
Quarterly Progress Report	USEPA	1/17/2017
Building 59 Closure Response to Comments	WDNR	1/27/2017
Responses to WDNR Review of Tyco Contract Documents – Subsurface Injection of Tracer Dye Scope of Work, dated March 30, 2016 and Technical Memorandum, Response to WDNR Questions Regarding Proposed Dye Testing, dated April 15, 2016	USEPA	1/31/2017
Quarterly Progress Report	USEPA	4/14/2017
WDNR Email - Response to Tyco's January 31, 2017 Response to Dye Testing Comments	WDNR	4/24/2017
Dye Testing Extension Request	USEPA	5/1/2017
Tyco Email - Response to Dye Testing Comments	WDNR	5/16/2017
Standard Operating Procedure - Surface Water Sampling	WDNR	5/31/2017
Planned Operation Procedure for Groundwater Treatment System Testing - Pump Down Program Optimization	WDNR	6/20/2017
WDNR - Department Additive Review of Keyacid Rhodamine WT Liquid Proposed Dye Testing	Tyco	6/26/2017
Response to USEPA Comments on 2016 Barrier Wall Groundwater Monitoring Plan Annual Report Recommendations	USEPA	7/7/2017
Quarterly Progress Report	USEPA	7/17/2017
Resident Notice - Dye Testing Implementation	USEPA	7/18/2017
Agenda for July 25, 2017 Meeting	USEPA	7/24/2017
Response to Tyco Comments on USEPA semi-annual sampling requirements	Tyco	8/9/2017
Pilot Dye test Work Plan	USEPA	8/14/2017
USEPA and WDNR Comments on Pilot Dye Test Work Plan	Tyco	8/22/2017
Responses to USEPA and WDNR Comments on Pilot Dye Test Work Plan	USEPA	9/1/2017
USEPA Email Approval of Pilot Dye Test Work Plan	Tyco	9/8/2017
Pump Down Program Response to July 25, 2017 Meeting	USEPA	9/11/2017
Quarterly Progress Report	USEPA	10/16/2017

Table 1. AOC Deliverable Summary

Tyco Fire Products LP, Marinette, Wisconsin

Description of Submittal	Submitted to	Date Submitted
September 2017 Pilot Dye Test Results Technical Memorandum and Meeting Request	USEPA	11/17/2017
Pump Down Program Summary Report	USEPA	12/6/2017
2018-2027 Cost Estimate	USEPA	12/7/2017
December 20, 2017 Meeting Presentation Materials	USEPA	12/22/2017
Pump Down Program Winter Operations and Optimization Report	USEPA	12/22/2017
Pump Down Program Work Plan	USEPA	1/12/2018
Quarterly Progress Report	USEPA	1/16/2018
Preliminary Draft Pump Down Program Focused Alternative Evaluation	USEPA	1/31/2018
USEPA Email - Pump Down Program Alternative - Agreement on Preferred Option	Tyco	2/16/2018
DGT literature for USEPA/WDNR	USEPA/WDNR	2/19/2018
Tyco Request to Pursue Menominee River Ordinance Removal	USEPA	2/20/2018
Dye Test Alternative Pilot Work Plan - Extension Request	USEPA	3/13/2018
USEPA Email - Approval of Dye Test Alternative Pilot Work Plan - Extension Request	Tyco	3/14/2018
Response to Tyco's Request to Remove Institutional Controls in the Menominee river	Tyco	3/15/2018
Clarification to Response to Institutional Controls Removal	USEPA	3/21/2018
Passive Arsenic Sampling Pilot Test Work Plan and Alternatives Evaluation	USEPA	3/30/2018
Quarterly Progress Report	USEPA	4/17/2018
USEPA Comment Letter on Tyco's "Passive Arsenic Sampling Pilot Test Work Plan and Alternatives Evaluation"	Tyco	4/26/2018
Response to RCRA 3007 Request	WDNR	5/11/2018
Draft Passive Arsenic Sampling Pilot Test Work Plan (USEPA DGT Disapproval)	Tyco	6/4/2018
Status Update Meeting Notes, May 16, 2018	USEPA	6/5/2018
2017 Barrier Wall Groundwater Monitoring Annual Report	USEPA	6/29/2018
GWCTS Modifications Phase I - Extraction Wells Conveyance System Basis of Design	WDNR	7/6/2018
Notification of Modification to Soil Covers	USEPA	7/6/2018
Quarterly Progress Report	USEPA	7/16/2018
Presentation on Enhanced Monitoring Well Network Proposal	USEPA	7/30/2018
Agency comments - 2017 Barrier Wall Groundwater Monitoring Annual Report	Tyco	7/30/2018
Response to Comments on 2017 Barrier Wall Groundwater Monitoring Annual Report	USEPA	8/27/2018
USEPA Email - 2017 Barrier Wall Groundwater Monitoring Annual Report Approval	Tyco	9/4/2018
USEPA Email - Tyco Sheet Pile Wall Monitoring	Tyco	9/4/2018
MW118D Well Abandonment Notification	WDNR	9/10/2018
Extraction Well Clean Out Notification	USEPA	9/10/2018
Extraction Well Clean Out Scope	WDNR	9/11/2018
USEPA Email with Tyco Sediment Data	Tyco	9/19/2018
2018 Sediment Monitoring report	USEPA	9/28/2018
Final Conveyance Design Drawings and Specifications	USEPA	9/28/2018
WDNR - Department Plan Approval Notification	Tyco	10/8/2018
Quarterly Progress Report	USEPA	10/15/2018
Tyco October 22, 2018 Project Status Meeting - Presentation Materials	USEPA	10/23/2018
Tyco October 22, 2018 Project Status Meeting - Meeting Notes	USEPA	11/1/2018
Pump Down Program Shut Down Notification	USEPA	11/5/2018

USEPA - U.S. Environmental Protection Agency
USACE - U.S. Army Corps of Engineers
WDNR - Wisconsin Department of Natural Resources
USEPA-GLNPO - U.S. Environmental Protection Agency-Great Lakes National Program Office
DGT - diffusive gradient in thin-film

Table 2. 2018 Barrier Wall Groundwater Monitoring Well Status

Tyco Fire Products LP, Marinette, Wisconsin

Wells	Location	Hydraulic Monitoring to Assess Fluctuations Relative to River, Bedrock and other Areas beyond Containment (Transducer)	Total Arsenic Concentration Trend Monitoring	Additional Parameter Monitoring (VOCs)	Manual Head Measurements for Gradient and Flow Assessment	Well Condition/Comments
MW001M	South side of former Salt Vault, inside contained area					Acceptable
MW001S	South side of former Salt Vault, inside contained area					Acceptable
MW002M	East side of former Salt Vault, inside contained area					Damaged during dredging activities, abandoned in November 2015
MW002S	East side of former Salt Vault, inside contained area					Damaged during dredging activities, abandoned in November 2015
MW002M-R	East side of former Salt Vault, inside contained area					Acceptable. New well extension and protective pipe installed in May 2017
MW002S-R	East side of former Salt Vault, inside contained area	continuous**				Acceptable. New well extension and protective pipe installed in May 2017
MW003D	Outside northwest property boundary, upgradient of wall		semi-annual		semi-annual	Acceptable
MW003M	Outside northwest property boundary, upgradient of wall		semi-annual		semi-annual	Acceptable
MW003S	Outside northwest property boundary, upgradient of wall	continuous++	semi-annual		semi-annual	Acceptable
MW004M	Southeastern portion of the property, inside contained area					Acceptable
MW004S	Southeastern portion of the property, inside contained area					Acceptable
MW006M	Northern portion of main plant area, inside of contained area					Abandoned during installation of 2010 barrier wall installation activities
MW006S	Northern portion of main plant area, inside of contained area					Abandoned during installation of 2010 barrier wall installation activities
MW007M	North side of former Salt Vault, inside contained area					Unable to be located for abandonment after dredging activities in November 2015, left in place per WDNR approval
MW007S	North side of former Salt Vault, inside contained area					Unable to be located for abandonment after dredging activities in November 2015, left in place per WDNR approval
MW008M	Northern portion of property, south of building 40, inside contained area					Acceptable
MW008S	Northern portion of property, south of building 40, inside contained area					Well was damaged, abandoned in November 2015
MW009M	Western property boundary north of Building 29, inside contained area					Acceptable
MW009S	Western property boundary north of Building 29, inside contained area					Acceptable
MW010M	Northern portion of main plant area, inside of contained area					Abandoned during installation of 2010 barrier wall installation activities
MW010S	Northern portion of main plant area, inside of contained area					Abandoned during installation of 2010 barrier wall installation activities
MW011M	Central portion of the site, inside of contained area					Acceptable
MW011S	Central portion of the site, inside of contained area					Acceptable
MW012M	South side of former Salt Vault, outside Salt Vault contained area, within main plant					Acceptable
MW012S	South side of former Salt Vault, outside Salt Vault contained area, within main plant					Acceptable
MW013D	Southwestern portion of the property, outside BW, background/upgradient				semi-annual	Acceptable
MW013M	Southwestern portion of the property, outside BW, background/upgradient				semi-annual	Acceptable
MW013S	Southwestern portion of the property, outside BW, background/upgradient				semi-annual	Acceptable
MW019S	Eastern portion of property in wetland area, east of/upgradient of contained area					Acceptable
MW020M	North side of former Salt Vault, inside contained area					Unable to be located for abandonment after dredging activities in November 2015, left in place per WDNR approval
MW020S	North side of former Salt Vault, inside contained area					Unable to be located for abandonment after dredging activities in November 2015, left in place per WDNR approval
MW021M	Outside southern portion of property boundary, upgradient side of contained area		semi-annual		semi-annual	Acceptable
MW021S	Outside southern portion of property boundary, upgradient side of contained area					Well was damaged, abandoned in November 2015
MW021S-R	Outside southern portion of property boundary, upgradient side of contained area		semi-annual		semi-annual	Acceptable

Table 2. 2018 Barrier Wall Groundwater Monitoring Well Status
Tyco Fire Products LP, Marinette, Wisconsin

Wells	Location	Hydraulic Monitoring to Assess Fluctuations Relative to River, Bedrock and other Areas beyond Containment (Transducer)	Total Arsenic Concentration Trend Monitoring	Additional Parameter Monitoring (VOCs)	Manual Head Measurements for Gradient and Flow Assessment	Well Condition/Comments
MW022M	Southeastern portion of wetlands area, upgradient of contained area				semi-annual	Acceptable
MW022S	Southeastern portion of wetlands area, upgradient of contained area				semi-annual	Acceptable
MW029M	North of former Salt Vault, outside contained area					Well removed in January 2013 during VBW stability work
MW029S	North of former Salt Vault, outside contained area					Well removed in January 2013 during VBW stability work
MW030M	North side of former Salt Vault, inside contained area					Well removed in February 2013 during VBW stability work
MW030S	North side of former Salt Vault, inside contained area					Well removed in February 2013 during VBW stability work
MW031M	West side of former Salt Vault, inside contained area					Acceptable
MW031S	West side of former Salt Vault, inside contained area					Acceptable. New extension and protective pipe installed in May 2017
MW032M	West side of former Salt Vault, outside salt vault contained area, inside main plant contained area					Acceptable
MW032S	West side of former Salt Vault, outside salt vault contained area, inside main plant contained area					Acceptable
MW033M-R	South side of former Salt Vault, outside salt vault contained area, inside main plant					Acceptable
MW033S-R	South side of former Salt Vault, outside salt vault contained area, inside main plant					Acceptable
MW034M	East side of 8th St. Slip, in slip					Acceptable. New extension and protective pipe installed in May 2017
MW034S	East side of 8th St. Slip, in slip					Acceptable. New extension and protective pipe installed in May 2017
MW035M	East side of 8th St. Slip, on wetland side					Acceptable. New extension and protective pipe installed in May 2017
MW035S	East side of 8th St. Slip, on wetland side					Acceptable. New extension and protective pipe installed in May 2017
MW036M	East side of 8th St. Slip, in slip					Acceptable. New extension and protective pipe installed in May 2017
MW036S	East side of 8th St. Slip, in slip					Acceptable. New extension and protective pipe installed in May 2017
MW037M	East side of 8th St. Slip, on wetland side					Acceptable. New extension and protective pipe installed in May 2017
MW037S	East side of 8th St. Slip, on wetland side					Acceptable. New extension and protective pipe installed in May 2017
MW038M	West side of 8th St. Slip, in slip					Acceptable
MW038S	West side of 8th St. Slip, in slip					Acceptable
MW039M	West side of 8th St. Slip, on main facility side					Acceptable
MW039S	West side of 8th St. Slip, on main facility side					Acceptable
MW040D	Southwestern side of operating facility, west/ outside of contained area		semi-annual		semi-annual	Acceptable, flush-mount replaced in 2018
MW040M-R	Southwestern side of operating facility, west/ outside of contained area		semi-annual		semi-annual	Acceptable, flush-mount replaced in 2018
MW040S	Southwestern side of operating facility, west/ outside of contained area	continuous*	semi-annual		semi-annual	Acceptable, flush-mount replaced in 2018
MW041D	North-central portion of site, inside of contained area					Well was consistently dry, abandoned in November 2015
MW041M	North-central portion of site, inside of contained area		semi-annual	VOCs every 5 years*	semi-annual	Acceptable
MW041S	North-central portion of site, inside of contained area		semi-annual	VOCs every 5 years*	semi-annual	Acceptable
MW042D	Southwest portion of the facility, inside of contained area					Acceptable
MW042M	Southwest portion of the facility, inside of contained area					Acceptable
MW042S	Southwest portion of the facility, inside of contained area					Acceptable
MW043M	Central portion of the site, inside of contained area					Acceptable
MW043S	Central portion of the site, inside of contained area					Acceptable

Table 2. 2018 Barrier Wall Groundwater Monitoring Well Status
Tyco Fire Products LP, Marinette, Wisconsin

Wells	Location	Hydraulic Monitoring to Assess Fluctuations Relative to River, Bedrock and other Areas beyond Containment (Transducer)	Total Arsenic Concentration Trend Monitoring	Additional Parameter Monitoring (VOCs)	Manual Head Measurements for Gradient and Flow Assessment	Well Condition/Comments
MW044M-R	Central portion of the site, inside of contained area					Acceptable
MW044S-R	Central portion of the site, inside of contained area					Acceptable
MW045M	Northern portion of main plant area, inside of contained area			VOCs every 5 years*	semi-annual	Acceptable
MW045S	Northern portion of main plant area, inside of contained area			VOCs every 5 years*	semi-annual	Acceptable
MW046D	Northern portion of wetlands area, inside of contained area					Acceptable
MW046M	Northern portion of wetlands area, inside of contained area					Acceptable
MW046S	Northern portion of wetlands area, inside of contained area					Acceptable
MW047D	Northern portion of wetlands area, inside of contained area	continuous	semi-annual		semi-annual	Acceptable, well pad installed in 2018
MW047M	Northern portion of wetlands area, inside of contained area		semi-annual		semi-annual	Acceptable, well pad installed in 2018
MW047S	Northern portion of wetlands area, inside of contained area	continuous	semi-annual		semi-annual	Acceptable, well pad installed in 2018
MW048M	Northeast portion of wetlands area, outside of contained area					
MW048S	Northeast portion of wetlands area, outside of contained area					
MW049M	Southeastern portion of wetlands area, upgradient of contained area					Acceptable
MW049S	Southeastern portion of wetlands area, upgradient of contained area					Acceptable
MW050M	Southern portion of the site, within contained area					Acceptable
MW050S	Southern portion of the site, within contained area					Acceptable
MW052S	Central portion of main plant area, inside of contained area					Unable to be located
MW053S	Central portion of main plant area, inside of contained area					Acceptable
MW054S	Central portion of main plant area, inside of contained area					Acceptable
MW059M	Southern portion of the site, within contained area					Acceptable
MW059S	Southern portion of the site, within contained area					Acceptable
MW060M	Southern portion of the site, within contained area					Acceptable
MW060S	Southern portion of the site, within contained area					Acceptable
MW061M	Southern portion of the site, within contained area					Acceptable
MW061S	Southern portion of the site, within contained area					Acceptable
MW062M	Southern portion of the site, within contained area					Acceptable
MW062S	Southern portion of the site, within contained area					Acceptable
MW063M	Southern portion of the site, within contained area					Acceptable
MW063S	Southern portion of the site, within contained area					Acceptable
MW064D	Southern portion of the site, within contained area	continuous	semi-annual		semi-annual	Acceptable
MW064M	Southern portion of the site, within contained area		semi-annual		semi-annual	Acceptable
MW064S	Southern portion of the site, within contained area	continuous	semi-annual		semi-annual	Acceptable
MW065D	South-central portion of the site, within contained area					Well abandoned in 2013
MW065M	South-central portion of the site, within contained area					Well abandoned in 2013
MW065S	South-central portion of the site, within contained area					Well abandoned in 2013
MW066S	South-central portion of the site, within contained area					Acceptable
MW066M	South-central portion of the site, within contained area					Acceptable
MW067S	Northwestern portion of the facility, inside contained area					Acceptable
MW068S	Northern portion of the facility, inside contained area					Acceptable
MW100D	Eastern portion of property in wetland area, east of/upgradient of contained area		semi-annual		semi-annual	Acceptable, well pad installed in 2018
MW100M	Eastern portion of property in wetland area, east of/upgradient of contained area		semi-annual		semi-annual	Acceptable, well pad installed in 2018
MW100S	Eastern portion of property in wetland area, east of/upgradient of contained area	continuous	semi-annual		semi-annual	Acceptable, well pad installed in 2018
MW101M	Within southern portion of wetlands area, within contained area		semi-annual		semi-annual	Acceptable
MW101S	Within southern portion of wetlands area, within contained area		semi-annual		semi-annual	Acceptable
MW102D	Outside southern boundary of barrier wall, upgradient of contained zone		semi-annual		semi-annual	Acceptable

Table 2. 2018 Barrier Wall Groundwater Monitoring Well Status
Tyco Fire Products LP, Marinette, Wisconsin

Wells	Location	Hydraulic Monitoring to Assess Fluctuations Relative to River, Bedrock and other Areas beyond Containment (Transducer)	Total Arsenic Concentration Trend Monitoring	Additional Parameter Monitoring (VOCs)	Manual Head Measurements for Gradient and Flow Assessment	Well Condition/Comments
MW102M	Outside southern boundary of barrier wall, upgradient of contained zone		semi-annual		semi-annual	Acceptable
MW102S	Outside southern boundary of barrier wall, upgradient of contained zone	continuous	semi-annual		semi-annual	Acceptable
MW103M	South-southwest portion of facility, inside contained zone		semi-annual		semi-annual	Acceptable
MW103S	South-southwest portion of facility, inside contained zone		semi-annual		semi-annual	Acceptable
MW104M	South-southwestern portion of the facility, outside contained zone		semi-annual		semi-annual	Acceptable
MW104S	South-southwestern portion of the facility, outside contained zone		semi-annual		semi-annual	Acceptable
MW105D	Southwestern portion of the facility, inside contained zone	continuous*	semi-annual		semi-annual	Acceptable, flush-mount removed and well extension added in 2018
MW105M	Southwestern portion of the facility, inside contained zone		semi-annual		semi-annual	Acceptable, flush-mount removed and well extension added in 2018
MW105S	Southwestern portion of the facility, inside contained zone	continuous*	semi-annual		semi-annual	Acceptable, flush-mount removed and well extension added in 2018
MW106D	Northwestern portion of the facility, inside the contained zone	continuous**	semi-annual		semi-annual	Acceptable
MW106M	Northwestern portion of the facility, inside the contained zone		semi-annual		semi-annual	Acceptable
MW106S	Northwestern portion of the facility, inside the contained zone	continuous**	semi-annual		semi-annual	Acceptable
MW107M	Northern portion of the facility, inside contained area		semi-annual		semi-annual	Acceptable
MW107D	Northern portion of the facility, inside contained area		semi-annual		semi-annual	Acceptable
MW108D	Northern portion of the facility, inside contained area	continuous	semi-annual		semi-annual	Acceptable
MW108M	Northern portion of the facility, inside contained area		semi-annual	VOCs every 5 years*	semi-annual	Acceptable
MW108S	Northern portion of the facility, inside contained area	continuous	semi-annual	VOCs every 5 years*	semi-annual	Acceptable
MW109D	Northwest portion of the wetlands area, inside contained area	continuous	semi-annual		semi-annual	Acceptable
MW109M	Northwest portion of the wetlands area, inside contained area		semi-annual		semi-annual	Acceptable
MW109S	Northwest portion of the wetlands area, inside contained area	continuous	semi-annual		semi-annual	Acceptable
PZ110A	Well along shoreline, installed in January 2012					Well removed in December 2012 during VBW stability work
PZ110B	Well along shoreline, installed in January 2012					Well removed in December 2012 during VBW stability work
PZ110C	Well along shoreline, installed in January 2012					Well removed in December 2012 during VBW stability work
MW110D	Well along shoreline, installed in January 2012					Well removed in December 2012 during VBW stability work
PZ111A	Well along shoreline, installed in January 2012					Well removed in February 2013 during VBW stability work
PZ111B	Well along shoreline, installed in January 2012					Well removed in February 2013 during VBW stability work
PZ111C	Well along shoreline, installed in January 2012					Well removed in February 2013 during VBW stability work
MW111D	Well along shoreline, installed in January 2012					Well removed in February 2013 during VBW stability work
PZ112A	Well along shoreline, installed in January 2012					Well removed in February 2013 during VBW stability work
PZ112B	Well along shoreline, installed in January 2012					Well removed in February 2013 during VBW stability work
PZ112C	Well along shoreline, installed in January 2012					Well removed in February 2013 during VBW stability work
MW112D	Well along shoreline, installed in January 2012					Well removed in February 2013 during VBW stability work
PZ113A	Well on island, installed in January 2012					Well removed during dredging in 2013/2014
PZ113B	Well on island, installed in January 2012					Well removed during dredging in 2013/2014
PZ114A	Well on island, installed in January 2012					Well removed during dredging in 2013/2014
PZ114B	Well on island, installed in January 2012					Well removed during dredging in 2013/2014
MW113S	Well near EW-11 - Salt Vault inside contained area					Acceptable. New extension and protective pipe installed in May 2017
MW113M	Well near EW-11 - Salt Vault inside contained area					Acceptable. New extension and protective pipe installed in May 2017
MW114S	Well near EW-12- Main Plant Area inside contained area					Acceptable
MW114M	Well near EW-12- Main Plant Area inside contained area					Acceptable
MW115P	Well near EW-13- Salt Vault inside contained area		annual*		semi-annual	Acceptable. New extension and protective pipe installed in May 2017

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Table 2. 2018 Barrier Wall Groundwater Monitoring Well Status
Tyco Fire Products LP, Marinette, Wisconsin

Wells	Location	Hydraulic Monitoring to Assess Fluctuations Relative to River, Bedrock and other Areas beyond Containment (Transducer)	Total Arsenic Concentration Trend Monitoring	Additional Parameter Monitoring (VOCs)	Manual Head Measurements for Gradient and Flow Assessment	Well Condition/Comments
MW115S	Well near EW-13- Salt Vault inside contained area	continuous**	annual*		semi-annual	Acceptable. New extension and protective pipe installed in May 2017
MW116P	Well near EW-14- Salt Vault inside contained area					Acceptable. New extension and protective pipe installed in May 2017
MW116S	Well near EW-14- Salt Vault inside contained area					Acceptable. New extension and protective pipe installed in May 2017
MW117D	Northern portion of the Main Plant Area, within contained area near river	continuous	semi-annual		semi-annual	Acceptable
MW117M	Northern portion of the Main Plant Area, within contained area near river		semi-annual	VOCs every 5 years*	semi-annual	Acceptable
MW117S	Northern portion of the Main Plant Area, within contained area near river	continuous	semi-annual	VOCs every 5 years*	semi-annual	Acceptable
MW118D	Northern portion of the Main Plant Area, within contained area near river	continuous	semi-annual		semi-annual	Well damaged, abandoned in August 2018
MW118M	Northern portion of the Main Plant Area, within contained area near river		semi-annual		semi-annual	Acceptable. New extension and protective pipe installed in May 2017
MW118S	Northern portion of the Main Plant Area, within contained area near river	continuous	semi-annual		semi-annual	Acceptable. New extension and protective pipe installed in May 2017
MW119D	Well near EW-13- Salt Vault inside contained area	continuous	annual*		semi-annual	Acceptable. New extension and protective pipe installed in May 2017
MW120D	8th Street Slip just inside the tie-backs for the sheet pile wall	continuous	annual*		semi-annual	Acceptable. New extension and protective pipe installed in May 2017
MW120M	8th Street Slip just inside the tie-backs for the sheet pile wall		annual*		semi-annual	Acceptable. New extension and protective pipe installed in May 2017
MW120S	8th Street Slip just inside the tie-backs for the sheet pile wall	continuous**	annual*		semi-annual	Acceptable. New extension and protective pipe installed in May 2017
SG-3	Staff Gauge Northwest of barrier wall in Menomonee River					Removed
SG4	Staff Gauge - Menominee River	continuous			semi-annual	Staff gauge installed in 2016
EW-1	GWCTS extraction well in wetland area					Acceptable
EW-2	GWCTS extraction well in 8th Street Slip					Acceptable
EW-3	GWCTS extraction well in Salt Vault					Acceptable
EW-4	GWCTS extraction well in Main Plant area - NE					Acceptable
EW-5	GWCTS extraction well in main plant area - South Central					Acceptable
EW-6	GWCTS extraction well in main plant area - South Central					Acceptable
EW-7	GWCTS extraction well in main plant area - NW					Acceptable
EW-8	Extraction Test Well - 8th Street Slip inside contained area					Acceptable
EW-9	Extraction Test Well - 8th Street Slip inside contained area					Acceptable
EW-10	Extraction Test Well - Salt Vault inside contained area					Acceptable
EW-11	Extraction Test Well - Salt Vault inside contained area					Acceptable
EW-12	Extraction Test Well - Main Plant Area inside contained area					Acceptable
EW-13	Extraction Test Well - Salt Vault inside contained area					Acceptable
EW-14	Extraction Test Well - Salt Vault inside contained area					Acceptable
BT-01	Bedrock Test Well - Wetland Area inside contained area					Acceptable
BT-02	Bedrock Test Well - Main Plant Area inside contained area					Acceptable
VW-TB01-565.0	River VWP in Turning Basin ~100 feet from shore					Removed during dredging operations
VW-TB01-550.0	River VWP in Turning Basin ~100 feet from shore					Removed during dredging operations
VW-TB02-560.0	River VWP in Turning Basin ~250 feet from shore					Removed during dredging operations
VW-TB02-545.0	River VWP in Turning Basin ~250 feet from shore					Removed during dredging operations
VW-TA01-555.0	River VWP in Transition Area 2 ~100 feet from shore					Removed during dredging operations
VW-TA01-540.0	River VWP in Transition Area 2 ~100 feet from shore					Removed during dredging operations
VW-TA02-555.0	River VWP in Transition Area 3 ~100 feet from shore					Removed during dredging operations
VW-TA02-540.0	River VWP in Transition Area 3 ~100 feet from shore					Removed during dredging operations

Table 2. 2018 Barrier Wall Groundwater Monitoring Well Status
Tyco Fire Products LP, Marinette, Wisconsin

Wells	Location	Hydraulic Monitoring to Assess Fluctuations Relative to River, Bedrock and other Areas beyond Containment (Transducer)	Total Arsenic Concentration Trend Monitoring	Additional Parameter Monitoring (VOCs)	Manual Head Measurements for Gradient and Flow Assessment	Well Condition/Comments
VW-SG01	Northwest of barrier wall in Menomonee River					Removed during dredging operations
PZ01	South-central portion of the site, within contained area, used to historically monitor trees					
PZ02	South-central portion of the site, within contained area, used to historically monitor trees					
PZ03	South-central portion of the site, within contained area, used to historically monitor trees					
PZ04	South-central portion of the site, within contained area, used to historically monitor trees					
PZ05	South-central portion of the site, within contained area, used to historically monitor trees					
PZ06	South-central portion of the site, within contained area, used to historically monitor trees					
PZ07	South-central portion of the site, within contained area, used to historically monitor trees					
PZ08	South-central portion of the site, within contained area, used to historically monitor trees					
PZ09	South-central portion of the site, within contained area, used to historically monitor trees					
PZ10	South-central portion of the site, within contained area, used to historically monitor trees					

Notes:
Manual = Manual transducer installed, not connected to centralized data logger
GWCTS = groundwater collection and treatment system
VWP = Transducer installed and connected to centralized data logger
VBW = Vertical barrier wall

*Arsenic baseline event for 2015 BWGMPU occurred in December 2015, with additional sampling in 2016, 2017, and 2018, and planned for 2023. VOCs baseline event also occurred in December 2015 and May 2018, with additional sampling planned for 2023.

** - Continuous hydraulic monitoring is obtained with a pressure transducer for monitoring of pump down program only
+ - transducer removed in July 2017 and relocated to another monitoring well
++ - transducer installed in July 2017
Blank cell indicates well is not part of the barrier wall groundwater monitoring network

Continuous hydraulic monitoring was obtained with a pressure transducer that recorded water levels every 30 minutes through June 2017 and subsequently changed to once per hour. Data is downloaded quarterly; manual water levels are measured at the time of each download.

Semi-annual monitoring started in fall 2015 through fall 2018. Annual sampling may start in 2019 unless increasing trends in arsenic concentrations are observed, in which case semi-annual groundwater sampling will continue for at least 1 additional year.

Table 3. 2012-2018 GWCTS Monthly Extraction Well Average Pumping Rates (in Gallons per Minute)
Tyco Fire Products LP, Marinette, Wisconsin

	Extraction Well						
Month	EW-1	EW-2	EW-3	EW-4	EW-5	EW-6	EW-7
Jan-12	0.74	0.14	0.10	0.11	0.10	0.62	0.69
Feb-12	1.51	0.28	0.17	0.20	0.13	0.66	0.71
Mar-12	3.87	0.69	0.24	0.42	0.17	0.78	0.77
Apr-12	7.37	1.16	0.22	0.72	0.04	1.26	1.39
May-12	5.98	0.69	0.15	0.58	1.24	2.40	2.70
Jun-12	7.11	1.12	0.17	0.66	1.91	2.20	2.43
Jul-12	3.10	0.69	0.12	0.39	2.15	2.06	2.35
Aug-12	2.37	1.05	0.12	0.54	0.07	5.52	6.11
Sep-12	0.27	0.31	0.02	0.37	0.00	5.47	4.16
Oct-12	0.00	0.00	0.00	0.00	0.05	2.03	2.28
Nov-12	1.26	0.61	0.07	0.24	0.56	5.72	6.02
Dec-12	1.57	0.79	0.11	0.28	0.48	2.58	2.55
Jan-13	0.43	0.25	0.04	0.35	2.36	5.74	4.16
Feb-13	0.00	0.00	0.00	0.33	1.88	6.22	1.99
Mar-13	0.00	0.00	0.00	0.14	2.60	10.51	0.02
Apr-13	2.44	0.35	0.17	0.24	1.81	6.63	0.00
May-13	4.79	0.71	0.10	0.39	1.93	5.19	0.00
Jun-13	5.28	0.74	0.12	0.39	2.20	6.28	0.00
Jul-13	5.78	1.00	0.13	0.16	-20.21	7.01	0.00
Aug-13	2.07	1.17	0.16	0.10	2.16	9.05	0.00
Sep-13	0.06	1.04	0.17	0.12	1.98	8.20	0.00
Oct-13	0.09	0.86	0.17	0.00	2.59	2.30	0.00
Nov-13	0.00	0.53	0.12	0.00	1.77	3.20	3.28
Dec-13	1.58	0.54	0.14	0.23	2.44	3.54	2.29
Jan-14	2.40	0.42	0.17	0.09	1.39	2.68	2.57
Feb-14	2.64	0.38	0.14	0.18	1.63	2.55	3.73
Mar-14	4.03	0.20	0.08	0.19	1.40	2.15	5.17
Apr-14	4.39	0.15	0.08	0.40	2.71	4.56	3.33
May-14	3.91	0.30	0.12	0.31	2.10	4.40	3.14
Jun-14	3.47	0.67	0.27	0.15	1.71	5.04	2.83
Jul-14	3.57	0.62	0.21	0.30	1.43	4.75	3.14
Aug-14	3.62	0.73	0.31	0.23	1.36	6.56	3.93
Sep-14	4.36	0.45	0.25	0.47	1.83	0.78	0.52
Oct-14	4.10	0.55	0.15	0.43	1.77	0.95	6.09
Nov-14	1.89	0.31	0.09	0.32	1.36	4.79	4.51
Dec-14	1.85	0.34	0.10	0.31	1.26	4.18	4.32
Jan-15	2.37	0.30	0.12	0.35	1.55	4.06	4.49
Feb-15	2.56	0.25	0.14	0.39	1.69	4.82	5.23
Mar-15	1.99	0.10	0.13	0.41	1.57	4.89	5.20
Apr-15	1.69	0.06	0.12	0.41	1.37	3.70	3.84
May-15	1.56	0.41	0.28	0.22	1.33	3.66	3.82
Jun-15	1.70	0.46	0.18	0.03	1.48	4.41	4.44
Jul-15	2.49	0.56	0.16	0.14	2.52	5.54	5.35
Aug-15	3.19	0.44	0.14	0.22	0.99	2.66	6.25
Sep-15	3.21	0.45	0.16	0.24	0.00	0.00	5.42
Oct-15	2.78	0.25	0.15	0.20	1.13	3.95	1.78
Nov-15	1.78	0.12	0.11	0.16	1.52	5.74	1.19
Dec-15	1.39	0.07	0.09	0.13	1.26	4.92	0.84
Jan-16	3.20	0.20	0.20	0.20	2.40	10.20	2.10
Feb-16	3.00	0.20	0.20	0.20	2.20	8.90	3.00
Mar-16	4.40	0.60	0.00	0.30	3.00	4.70	4.00
Apr-16	4.10	0.80	0.00	0.40	2.90	4.50	3.80
May-16	2.50	0.60	0.00	0.30	0.10	10.00	0.10
Jun-16	2.60	0.80	0.00	0.40	0.00	11.00	0.20
Jul-16	0.90	0.10	0.00	0.10	0.60	3.50	2.80
Aug-16	0.70	0.10	0.00	0.10	0.90	3.90	3.00
Sep-16	0.00	0.00	0.00	0.30	4.50	9.00	5.80
Oct-16	0.00	0.00	0.00	0.00	0.15	0.31	0.17
Nov-16	0.11	0.00	0.01	0.05	1.01	1.84	0.94
Dec-16	0.45	0.01	0.06	0.07	1.26	1.94	1.12
Jan-17	0.44	0.01	0.07	0.10	1.48	2.24	0.97

Table 3. 2012-2018 GWCTS Monthly Extraction Well Average Pumping Rates (in Gallons per Minute)

Tyco Fire Products LP, Marinette, Wisconsin

Month	Extraction Well						
	EW-1	EW-2	EW-3	EW-4	EW-5	EW-6	EW-7
Feb-17	0.89	0.01	0.10	0.13	2.25	3.75	1.00
Mar-17	0.38	0.01	0.08	0.13	2.16	3.10	0.86
Apr-17	0.21	0.00	0.06	0.08	1.36	2.06	1.29
May-17	0.40	0.00	0.07	0.12	2.11	2.64	2.77
Jun-17	0.53	0.00	0.10	0.16	2.84	3.19	2.40
Jul-17	0.25	0.00	0.03	0.03	1.53	0.84	0.92
Aug-17	0.48	0.00	0.05	0.02	1.79	0.73	1.04
Sep-17	0.85	0.00	0.00	0.04	0.55	2.23	0.67
Oct-17	0.45	0.00	0.00	0.05	0.23	2.21	1.12
Nov-17	0.40	0.00	0.00	0.02	0.20	2.11	1.05
Dec-17	0.64	0.00	0.05	0.03	0.52	2.65	1.31
Jan-18	0.52	0.00	0.02	0.02	0.44	0.54	0.52
Feb-18	0.63	0.00	0.02	0.03	0.51	0.63	0.62
Mar-18	1.05	0.00	0.04	0.04	1.11	1.31	1.29
Apr-18	0.58	0.00	0.03	0.03	2.30	1.18	0.57
May-18	0.56	0.00	0.03	0.03	0.80	2.64	2.16
Jun-18	0.54	0.00	0.03	0.03	0.77	2.85	2.18
Jul-18	0.62	0.00	0.02	0.03	1.16	2.96	2.00
Aug-18	0.08	0.00	0.00	0.00	0.37	0.36	0.31
Sep-18	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oct-18	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Pumping averages are presented in gallons per minute

Pumping averages are calculated as if the system were operating 24-hours a day, 7-days a week

GWCTS = groundwater collection and treatment system

Table 4. Barrier Wall Groundwater Monitoring Groundwater Elevation Data
Tyco Fire Products LP, Marinette, Wisconsin

Well ID	Corrected Groundwater Elevation (for equivalent fresh water)									
	May 19, 2014	December 31, 2014	June 24, 2015	December 8, 2015	April 30, 2016	October 18, 2016	April 24, 2017	October 11, 2017	April 25/26, 2018	September 11, 2018
MW001M*	NM	NM	NM	NM	NM	NM	581.53	581.16	577.97	577.43
MW001S*	NM	NM	NM	NM	NM	NM	581.54	581.15	579.07	578.47
MW002M-R*	NM	NM	NM	NM	NM	NM	581.75	581.42	579.53	578.72
MW002S-R*	NM	NM	NM	NM	NM	NM	581.52	581.52	579.27	578.47
MW003D	579.94	579.63	580.39	579.59	580.72	580.09	580.47	581.08	580.55	581.00
MW003M	580.83	579.79	580.38	579.60	580.60	580.17	580.53	581.03	580.70	580.94
MW003S	579.70	580.05	580.16	579.43	580.24	581.12	580.41	580.60	581.36	581.06
MW004M	582.62	582.25	582.38	NM	NM	NM	583.00	NM	NM	NM
MW004S*	582.84	582.41	582.38	NM	NM	NM	583.32	582.64	583.99	582.51
MW008M	580.49	580.56	580.47	NM	NM	NM	NM	NM	NM	NM
MW008S	NM	NM	NM	A	A	A	A	A	A	A
MW009M	581.00	580.90	580.01	NM	NM	NM	NM	NM	NM	NM
MW009S	581.06	580.53	580.65	NM	NM	NM	NM	NM	NM	NM
MW011M	NM	NM	581.02	NM	NM	NM	NM	NM	NM	NM
MW011S	NM	NM	581.32	NM	NM	NM	NM	NM	NM	NM
MW012M	NM	NM	581.82	NM	NM	NM	NM	NM	NM	NM
MW012S	NM	NM	582.22	NM	NM	NM	NM	NM	NM	NM
MW013D	582.68	582.60	582.33	582.06	582.96	582.46	582.82	583.03	582.86	582.96
MW013M	584.42	584.39	583.52	583.55	584.26	583.85	584.18	584.01	584.39	584.22
MW013S	584.96	585.01	583.88	584.02	584.63	584.58	584.62	584.34	584.88	584.57
MW021M* **	NM	582.75	581.73	581.62	582.67	582.12	582.68	582.36	583.03	582.21
MW021S***	NM	NM	NM	A	A	A	A	A	A	A
MW021S-R	NM	NM	NM	582.00	582.68	582.33	582.66	582.54	583.06	582.41
MW022M	580.57	581.32	580.72	579.85	581.24	580.97	581.14	581.38	581.41 +	581.37
MW022S	580.57	581.09	580.69	579.98	581.21	580.94	581.12	581.36	581.25	581.28
MW029M	A	A	A	A	A	A	A	A	A	A
MW029S	A	A	A	A	A	A	A	A	A	A
MW030M	A	A	A	A	A	A	A	A	A	A
MW030S	A	A	A	A	A	A	A	A	A	A
MW031M*	578.10	NM	583.50	NM	NM	NM	581.58	581.16	579.52	578.71
MW031S*	583.31	NM	583.95	NM	NM	NM	581.49	581.15	579.99	578.50
MW032M*	583.50	NM	581.45	NM	NM	NM	582.19	581.96	582.76	581.93
MW032S*	584.76	NM	582.63	NM	NM	NM	583.10	582.43	582.12	582.18
MW033M*	NM	NM	NM	NM	NM	NM	584.41	583.64	585.23	583.66
MW033S*	NM	NM	NM	NM	NM	NM	583.17	582.47	583.99	582.39
MW034M*	NM	NM	583.12	NM	NM	NM	578.91	579.94	579.37	574.61
MW034S*	NM	NM	583.13	NM	NM	NM	578.76	579.81	579.17	574.35
MW035M*	NM	NM	579.56	NM	NM	NM	581.70	NM	NM	NM
MW035S*	NM	NM	580.07	NM	NM	NM	581.69	580.93	582.05	580.75
MW036M*	NM	NM	582.44	NM	NM	NM	578.49	579.49	579.64	574.17
MW036S*	NM	NM	582.82	NM	NM	NM	578.85	579.83	580.17	574.49
MW037M*	NM	NM	579.87	NM	NM	NM	583.88	NM	NM	NM
MW037S*	NM	NM	580.53	NM	NM	NM	581.84	580.84	582.19	580.58
MW038M*	580.55	NM	578.53	NM	NM	NM	579.05	579.75	579.79	574.17
MW038S*	580.32	NM	578.78	NM	NM	NM	579.10	579.78	579.75	574.07
MW039M*	NM	NM	582.41	NM	NM	NM	583.43	NM	NM	NM
MW039S*	NM	NM	582.40	NM	NM	NM	583.34	582.67	584.06	582.50
MW040D	579.42	580.61	580.49	579.82	580.81	580.51	580.51	581.18	580.31	581.70
MW040M-R	580.24	580.37	579.43	580.03	580.72	NM	578.62	580.85	578.32	581.68
MW040S	580.35	580.21	579.93	579.58	580.79	580.72	581.05	581.05	581.91	581.90
MW041D	539.31	NM	Dry	A	A	A	A	A	A	A
MW041M	580.73	NM	580.00	580.07	580.50	580.91	581.46	581.69	582.28	581.97
MW041S	580.80	NM	580.30	579.95	580.63	581.06	581.56	581.77	582.47	582.15
MW042D	582.52	582.42	582.42	NM	NM	NM	NM	NM	NM	NM
MW042M	581.79	581.71	580.65	NM	NM	NM	NM	NM	NM	NM
MW042S	582.13	581.89	580.50	NM	NM	NM	NM	NM	NM	NM
MW043M	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW043S	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW044M-R	582.50	582.33	581.37	NM	NM	NM	NM	NM	NM	NM
MW044S-R	582.66	582.25	581.72	NM	NM	NM	NM	NM	NM	NM
MW045M	579.98	NM	580.22	580.43	NM	580.53	581.54	581.5**	582.40	582.00
MW045S	580.02	NM	580.10	580.17	NM	580.83	581.19	581.37**	582.07 +	581.97
MW046D	NM	NM	580.49	NM	NM	NM	NM	NM	NM	NM
MW046M	NM	NM	580.12	NM	NM	NM	NM	NM	NM	NM
MW046S	NM	NM	579.95	NM	NM	NM	NM	NM	NM	NM

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Table 4. Barrier Wall Groundwater Monitoring Groundwater Elevation Data
Tyco Fire Products LP, Marinette, Wisconsin

Well ID	Corrected Groundwater Elevation (for equivalent fresh water)									
	May 19, 2014	December 31, 2014	June 24, 2015	December 8, 2015	April 30, 2016	October 18, 2016	April 24, 2017	October 11, 2017	April 25/26, 2018	September 11, 2018
MW047D	579.94	580.32	580.41	579.75	580.79	581.44	580.61	581.19	580.83	581.20
MW047M	580.13	580.73	580.20	579.36	581.10	580.36	581.06	580.98	581.22	580.80
MW047S	579.90	580.90	579.83	581.47	581.75	580.26	581.87	580.67	582.02	580.40
MW048M	NM	NM	580.23	NM	NM	NM	NM	NM	NM	NM
MW048S	NM	NM	580.18	NM	NM	NM	NM	NM	NM	NM
MW049M	NM	NM	581.08	NM	NM	NM	NM	NM	NM	NM
MW049S	NM	NM	581.04	NM	NM	NM	NM	NM	NM	NM
MW050M	NM	NM	582.01	NM	NM	NM	NM	NM	NM	NM
MW050S	NM	NM	582.10	NM	NM	NM	NM	NM	NM	NM
MW052S	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW053S	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW054S	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW059M	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW059S	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW060M	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW060S	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW061M	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW061S	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW062M	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW062S	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW063M	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW063S	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW064D	580.06	579.80	580.40	579.88	582.64	580.46	580.74	581.28	580.76	581.20
MW064M	583.14	582.84	581.74	581.06	580.78	581.67	583.17	582.28	584.08	582.25
MW064S	582.99	582.89	581.69	582.02	581.20	581.51	582.95	582.03	583.87	581.87
MW065D	A	A	A	A	A	A	A	A	A	A
MW065M	A	A	A	A	A	A	A	A	A	A
MW065S	A	A	A	A	A	A	A	A	A	A
MW066M	NM	NM	581.98	NM	NM	NM	NM	NM	NM	NM
MW066S	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW067S	580.75	NM	580.12	NM	NM	NM	NM	NM	NM	NM
MW068S	NM	NM	580.45	NM	NM	NM	NM	NM	NM	NM
MW100D	580.00	580.38	580.34	579.76	580.78	580.57	580.63	581.21	581.09 +	581.10
MW100M	580.41	581.03	580.51	580.11	581.20	580.83	581.16	581.26	581.53 +	581.30
MW100S	580.45	580.71	580.49	580.21	581.14	580.88	581.00	581.29	581.44 +	581.35
MW101M	580.22	581.14	579.97	579.08	581.90	580.48	582.01	580.87	582.24	580.63
MW101S	579.50	580.95	579.73	578.71	581.79	580.21	581.95	580.62	582.13	580.39
MW102D	580.05	580.02	580.60	579.97	580.97	580.47	580.73	581.23	580.83	581.18
MW102M	583.26	583.17	582.29	582.06	582.74	582.20	582.26	582.22	582.32	582.17
MW102S	584.42	583.57	583.33	583.69	584.47	584.04	584.41	583.88	584.87	583.70
MW103M	581.99	582.13	580.59	580.50	581.82	581.22	582.44	581.77	583.39	582.17
MW103S	582.17	581.66	580.65	580.57	582.19	581.22	582.69	581.96	584.07	582.13
MW104M	583.25	583.60	582.46	582.77	583.18	582.86	583.26	582.84	583.78	583.09
MW104S	583.50	583.66	582.64	582.72	583.36	583.00	583.29	582.91	583.90	583.17
MW105D	581.03	581.08	580.31	580.02	580.53	581.69	581.81	582.01	>582.31 +	582.18
MW105M	580.04	578.79	580.04	580.52	581.24	581.21	581.65	581.65	>582.05 +	582.08
MW105S	581.40	578.76	580.42	580.73	581.44	580.79	581.23	581.20	>582.03 +	582.37
MW106D	580.13	579.42	580.32	580.12	580.63	580.24	580.44	581.15	580.61	580.99
MW106M	580.24	580.45	579.68	579.68	580.45	581.00	581.38	581.48	581.92	581.95
MW106S	578.82	580.67	579.99	579.46	580.33	581.13	581.65	581.66	581.20	582.03
MW107D	579.99	580.07	580.26	579.83	580.83	580.63	580.81	581.22	580.87	581.40
MW107M	-	-	-	NM	NM	581.02	581.46	581.68	582.03	581.93
MW108D	579.90	581.31	580.54	579.91	580.98	580.49	580.85	581.04	581.13	581.53
MW108M	581.72	581.69	581.01	580.61	581.68	581.57	582.08	581.95	582.72	582.18
MW108S	581.56	580.71	580.99	580.54	581.67	581.71	581.94	581.94	582.81	582.20
MW109D	579.96	579.56	580.29	579.71	580.71	580.53	580.61	581.17	580.83	581.02
MW109M	580.14	580.81	580.19	578.99	581.69	580.52	581.83	580.97	581.93	580.79
MW109S	580.09	580.77	580.06	579.07	581.61	580.57	581.92	581.06	582.01	580.86
MW113S*	580.75	NM	583.58	NM	NM	NM	581.60	581.17	579.04	578.53
MW113M*	580.16	NM	582.29	NM	NM	NM	581.88	581.67	580.67	580.04
MW114S	582.64	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW114M	581.27	NM	NM	NM	NM	NM	NM	NM	NM	NM
MW115P	580.89	NM	583.25	582.67	583.76	577.58	582.01	581.39	582.51	578.84
MW115S	580.61	NM	583.51	582.09	583.19	576.81	581.58	581.24	577.76	578.54

Table 4. Barrier Wall Groundwater Monitoring Groundwater Elevation Data

Tyco Fire Products LP, Marinette, Wisconsin

Well ID	Corrected Groundwater Elevation (for equivalent fresh water)									
	May 19, 2014	December 31, 2014	June 24, 2015	December 8, 2015	April 30, 2016	October 18, 2016	April 24, 2017	October 11, 2017	April 25/26, 2018	September 11, 2018
MW116P*	580.84	NM	583.67	NM	NM	NM	581.58	581.27	582.12	579.29
MW116S*	584.16	NM	583.57	NM	NM	NM	581.57	581.18	578.43	578.55
MW117D	NM	NM	NM	579.71	580.76	580.26	580.52	581.12	579.47 +	581.00
MW117M	NM	NM	NM	579.87	580.81	580.99	581.16	581.60	581.57 +	581.72
MW117S	NM	NM	NM	579.78	580.73	580.85	581.60	581.47	581.51 +	581.53
MW118D	NM	NM	NM	571.92	580.58	No Data	582.49	581.16	580.14 +	NM
MW118M	NM	NM	NM	579.90	580.85	580.93	581.26	581.80	581.89 +	582.00
MW118S	NM	NM	NM	579.87	580.79	580.89	580.16	581.68	581.75 +	581.83
MW119D	NM	NM	NM	535.68	577.88	580.11	577.58	580.02	580.56	578.45
MW120D	NM	NM	NM	579.71	580.82	580.69	585.86	581.42	581.17	581.29
MW120M	NM	NM	NM	581.82	582.77	576.14	578.98	580.03	580.88	575.45
MW120S	NM	NM	NM	581.70	582.60	576.09	578.96	579.87	581.43	575.67
SG4	579.72***	-	-	-	-	581.11	580.42	581.09	580.89	580.89

Notes:

Measurements were collected from top of casing (TOC). All depth measurements are in feet.

ID = identification

NM = Not Measured; MW = Monitoring Well; SG = Staff Gauge; A = Abandoned Well

Elevations are reported in feet above mean sea level (AMSL) relative top the North American Vertical Datum (NAVD) 1988

Shaded = Well part of 2011 Barrier Wall Groundwater Monitoring Plan groundwater elevation network; some wells were inaccessible, abandoned or damaged at the time of sampling. Refer to Table 2 for current well status.

Bold = Well part of 2015 Revised Barrier Wall Groundwater Monitoring Plan groundwater elevation network

- = Information not applicable or location was not yet installed

MW107M water level was not measured or recorded during the December 8, 2015 event

MW119D - groundwater recharge into monitoring well is slow due to bedrock conditions

The Staff Gauge (SG4) was installed April 4, 2016, so no river elevations were collected during the December 2014, and June and December 2015 events

* Measurements collected in 2016 and 2017 as part of pump down program

** Measurements collected on November 1, 2017.

***MW021S and MW021M were found to be silted in when the field team went to sample the wells in May 2014. The sediment was removed on 5/23/2014 and MW021S was found to have a broken casing at depth and will need to be replaced in the future. Due to the wells being silted in and the purging of the well to remove the sediment, an accurate reading for the depth to water was not able to be collected during the event

****Menominee River water elevation was collected from the transducer that was used for the ongoing aquifer testing. This transducer location was located near former SG2. Calculated river elevation is the average water elevation measured for May 19th between 9:20 and 14:20 (period of groundwater elevations); river elevations ranged from 579.59 ft AMSL (NAVD88) to 579.82 ft AMSL NAVD 1988 during this time.

+ April 2018 measurements had the following issues: MW022M well was frozen during initial round, measurement shown is from 5/9/18; MW045S was frozen during initial round, measurement shown is from 5/3/18; MW100D, MW100M, MW100S were under standing water and water level could not be collected, measurements shown are from 5/8/18; MW105D, MW105M, MW105S water was to top of casing and water levels are shown as greater than ">" the top of casing elevation, water elevations are likely attributable to a water main break in the area; MW117D, MW117M and MW117S were frozen during the initial round, measurements shown are from 5/7/18 or 5/3/18; MW118D, MW118M and MW118S were covered with snow during the initial round, measurements shown are from 5/3/18

Table 5. 2017-2018 Surface Water Total Arsenic Sampling Results
Tyco Fire Products LP, Marinette, Wisconsin

Sample Locations	June 7, 2017	September 8, 2017	September 26, 2017	November 9, 2017	November 22, 2017	May 10, 2018
Upstream 1	**1.1**	**0.83**	N/A	**0.92**	N/A	**0.75 J**
Downstream 2	**1.2**	**1.1**	N/A	**0.92**	N/A	**0.81 J**
Downstream 2 Duplicate	N/A	**1.1**	N/A	**0.94**	N/A	N/A
Downstream 3	**1.2**	**1.1**	N/A	**1.1**	N/A	**1.0**
Downstream 3 Duplicate	**1.1**	N/A	N/A	N/A	N/A	N/A
Downstream 4	**1.2**	**0.93**	N/A	**1.0**	N/A	**0.95 J**
Downstream 4 Duplicate	N/A	N/A	N/A	N/A	N/A	**0.98 J**
Marinette City Intake (Green Bay)	**0.77 J**	N/A	**1.1**	N/A	**0.83**	**0.77 J**
Menominee City Intake (Green Bay)	**1.2**	N/A	**1.1**	N/A	**1.0**	**0.71 J**
Field Blank	0.15 U	N/A	N/A	N/A	N/A	N/A

Notes

All results in micrograms per liter (µg/L)

J = the analyte was positively identified above the MDL; the result is considered an estimated concentration of the analyte in the sample

U = the analyte was analyzed for but was not detected above the laboratory reporting/quantitation limit

N/A = not analyzed

Groundwater Enforcement Standard (EF) = 10 µg/L (Wisconsin Administrative Code NR 140)

Groundwater Preventative Action Limit (PAL) = 1 µg/L (Wisconsin Administrative Code NR 140)

Wisconsin Pollutant Discharge and Elimination System effluent discharge criteria = 680 µg/L

Surface water acute standard = 339.8 µg/L (Table 1 of Wisconsin Administrative Code NR 105)

Surface water chronic standard = 152.2 µg/L (Table 5 of Wisconsin Administrative Code NR 105)

Human cancer criterion (HCC) for Lake Michigan = 0.2 µg/L (Table 9 of Wisconsin Administrative Code NR 105.09(3))

Bolded and shaded values indicate attainment or exceedance of the PAL and HCC for Lake Michigan

Bolded values indicate attainment or exceed of the HCC for Lake Michigan

All downstream results are consistent with upstream/background concentrations

Table 6. Monitoring Well Head Differences - Inside versus Outside Barrier Wall
Tyco Fire Products LP, Marinette, Wisconsin

Well Clusters	Location of the Monitoring Well Cluster Relative to the Site	Containment Area of Interior Monitoring Well	Head Difference [(Head Elevation Inside Barrier Wall) - (Head Elevation Outside Barrier Wall)] (ft)									
			May 2014	December 2014	June 2015	December 2015	April 2016	October 2016	April 2017	October 2017	April-May 2018	September 2018
MW064S / MW102S	Upgradient	Main Plant	-1.44	-0.69	-1.64	-1.67	-1.83	-2.53	-1.46	-1.85	-1.00	-1.83
MW064M / MW102M	Upgradient	Main Plant	-0.13	-0.34	-0.55	-1.00	0.06	-0.54	0.91	0.06	1.76	0.08
MW064D / MW102D	Upgradient	Main Plant	0.00	-0.23	-0.20	-0.09	-0.06	-0.01	0.01	0.05	-0.07	0.02
MW103S / MW104S	Upgradient	Main Plant	-1.32	-2.00	-1.99	-2.15	-1.16	-1.78	-0.60	-0.95	0.17	-1.04
MW103M / MW104M	Upgradient	Main Plant	-1.27	-1.48	-1.87	-2.27	-1.37	-1.65	-0.82	-1.07	-0.39	-0.92
MW105S / MW040S	Cross Gradient	Main Plant	1.05	-1.45	0.49	1.15	0.65	0.07	0.18	0.15	0.12	0.47
MW105M / MW040M-R	Cross Gradient	Main Plant	-0.19	-1.57	0.62	0.50	0.51	--	3.03	0.80	3.73	0.40
MW105D / MW040D	Cross Gradient	Main Plant	1.62	0.47	-0.18	0.20	-0.28	1.17	1.30	0.83	2.00	0.48
MW106S / MW003S	Cross Gradient	Main Plant	-0.88	0.62	-0.17	0.03	0.09	0.01	1.24	1.06	-0.16	0.97
MW106M / MW003M	Cross Gradient	Main Plant	-0.59	0.67	-0.70	0.08	-0.16	0.82	0.85	0.45	1.22	1.01
MW106D / MW003D	Cross Gradient	Main Plant	0.19	-0.21	-0.08	0.52	-0.09	0.15	-0.03	0.07	0.06	-0.01
MW047S / MW100S	Cross Gradient	Wetland Area	-0.54	0.20	-0.66	1.26	0.61	-0.62	0.87	-0.62	0.58	-0.95
MW047M / MW100M	Cross Gradient	Wetland Area	-0.30	-0.31	-0.31	-0.75	-0.10	-0.47	-0.10	-0.28	-0.31	-0.50
MW047D / MW100D	Cross Gradient	Wetland Area	-0.06	-0.06	0.07	-0.01	0.01	0.87	-0.02	-0.02	-0.26	0.10
MW101S / MW021S or MW021S-R	Upgradient	Wetland Area	--	--	--	-3.29	-0.89	-2.12	-0.71	-1.92	-0.93	-2.02
MW101M / MW021M	Upgradient	Wetland Area	--	-1.62	-1.76	-2.54	-0.78	-1.65	-0.67	-1.49	-0.79	-1.58
MW067S / River*	Downgradient	Main Plant	1.03	--	--	--	--	--	--	--	--	--
MW045S / River*	Downgradient	Main Plant	0.32	--	--	--	--	0.60	0.77	0.28	1.18	1.08
MW047S / River*	Downgradient	Wetland Area	0.20	--	--	--	--	0.03	1.45	-0.42	1.13	-0.49
MW108S / River*	Downgradient	Main Plant	1.86	--	--	--	--	1.48	1.52	0.85	1.92	1.31
MW109S / River*	Downgradient	Wetland Area	0.39	--	--	--	--	0.34	1.50	-0.03	1.12	-0.03
MW115P / River*	Downgradient	Salt Vault	1.17	--	--	--	--	-2.65	1.59	0.30	1.62	-2.05
MW115S / River*	Downgradient	Salt Vault	0.89	--	--	--	--	-3.42	1.16	0.15	-3.13	-2.35
MW117S / River*	Downgradient	Main Plant	--	--	--	--	--	0.62	1.18	0.38	0.62	0.64
MW118S / River*	Downgradient	Main Plant	--	--	--	--	--	0.66	-0.26	0.59	0.86	0.94
MW120S / River*	Downgradient	8th Street Slip	--	--	--	--	--	-4.14	-1.46	-1.22	0.54	-5.22

Notes:

All May 2014 measurements are from the May 19, 2014 event.
All December 2014 measurements are from the December 31, 2014 event.
All June 2015 measurements are from the June 24, 2015 event
All December 2015 measurements are from the December 8, 2015 event
All April 2016 measurements are from the April 30, 2016 event
All October 2016 measurements are from the October 18, 2016 event
All April 2017 measurements are from the April 24, 2017 event
October 2017 measurements are from the October 11, 2017 event (MW045S and MW045M were collected on November 1, 2017)

April 2018 measurements were mainly collected on April 25 and 26; however, had the following issues: MW022M well was frozen during initial round, measurement shown is from 5/9/18; MW045S was frozen during initial round, measurement shown is from 5/3/18; MW100D, MW100M, MW100S were under standing water and water level could not be collected, measurements shown are from 5/8/18; MW105D, MW105M, MW105S water was to top of casing, water elevations are likely attributable to a water main break in the area; MW117D, MW117M and MW117S were frozen during the initial round, measurements shown are from 5/7/18 or 5/3/18; MW118D, MW118M and MW118S were covered with snow during the initial round, measurements shown are from 5/3/18

MW021S was replaced with MW021S-R in November 2015
-- = Not applicable, well or staff gauge was not available for measurement due to obstruction, removal or was not yet installed.
*In 2014 Menominee River water elevation was collected from the transducer that was used for the ongoing aquifer testing. This transducer location was located near former SG2. In 2015 and April 2016, no transducer or staff gauge was installed to obtain a reading.
MW040M had water to top of casing during October 2016 event, which is suspected to be due to infiltration into well cover (flush-mounted). Therefore no water elevation measurement collected.
ft = feet   Elevation = feet above mean sea level in Wisconsin State Plane Coordinate System NAVD1988

Table 7. Monitoring Well Vertical Gradients – Outside Barrier Wall

Tyco Fire Products LP, Marinette, Wisconsin

Monitoring Well ID	Middle of PVC Screen Elevation (ft amsl)	Distance Between Middle of Well Screens (ft)	May 2014 Vertical Gradient (ft/ft)	May 2014 Vertical Gradient Direction	December 2014 Vertical Gradient (ft/ft)	December 2014 Vertical Gradient Direction	June 2015 Vertical Gradient (ft/ft)	June 2015 Vertical Gradient Direction	December 2015 Vertical Gradient (ft/ft)	December 2015 Vertical Gradient Direction	April 2016 Vertical Gradient (ft/ft)	April 2016 Vertical Gradient Direction	October 2016 Vertical Gradient (ft/ft)	October 2016 Vertical Gradient Direction	April 2017 Vertical Gradient (ft/ft)	April 2017 Vertical Gradient Direction	October 2017 Vertical Gradient (ft/ft)	October 2017 Vertical Gradient Direction	April-May 2018 Vertical Gradient (ft/ft)	April-May 2018 Vertical Gradient Direction	September 2018 Vertical Gradient (ft/ft)	September 2018 Vertical Gradient Direction	Nearby Containment Area
Medium Depth (M) to Shallow Depth (S)																							
MW003M	559.86	15.3	0.075	Up	-0.0157	Down	0.015	Up	0.011	Up	0.024	Up	-0.062	Down	0.008	Up	0.028	Up	-0.043	Down	-0.008	Down	Main Plant
MW003S	575.18																						
MW021M	557.79	18.3	--	--	--	--	--	--	-0.026	Down	0.000	Flat	-0.014	Down	0.001	Up	-0.012	Down	-0.002	Down	-0.014	Down	Wetland
MW021S	576.07																						
MW021S-R	572.48	14.7																					
MW022M	556.84	18.3	0.000	Flat	0.014	Up	0.001	Up	-0.007	Down	0.001	Up	0.001	Up	0.001	Up	0.001	Up	0.009	Up	0.005	Up	Wetland
MW022S	575.18																						
MW040M-R	560.56	11.5	-0.008	Down	0.015	Up	-0.044	Down	0.039	Up	-0.006	Down	No Data	NA	-0.211	Down	-0.017	Down	-0.312	Down	-0.018	Down	Main Plant
MW040S	572.07																						
MW100M	554.7	17.4	0.000	Flat	0.021	Up	0.001	Up	-0.005	Down	0.004	Up	-0.003	Down	0.009	Down	-0.002	Down	0.005	Up	-0.003	Down	Wetland
MW100S	572.14																						
MW102M	559.1	17.6	-0.065	Down	-0.022	Down	-0.059	Down	-0.093	Down	-0.099	Down	-0.105	Down	-0.122	Down	-0.094	Down	-0.145	Down	-0.087	Down	Main Plant
MW102S	576.68																						
MW104M	559.58	17.4	-0.013	Down	-0.002	Down	-0.011	Down	0.003	Up	-0.010	Down	-0.008	Down	-0.002	Down	-0.004	Down	-0.007	Down	-0.005	Down	Main Plant
MW104S	576.97																						
MW013M	557.59	23.1	-0.022	Down	-0.137	Down	-0.016	Down	-0.021	Down	-0.016	Down	-0.032	Down	-0.019	Down	-0.014	Down	-0.021	Down	-0.015	Down	Upgradient/ Administration Building
MW013S	580.65																						
Bedrock (D) to Medium Depth (M)																							
MW003D	540.63	34.6	-0.025	Down	-0.0038	Down	0.000	Flat	0.000	Flat	0.003	Up	-0.002	Down	-0.002	Down	0.001	Up	-0.004	Down	0.002	Up	Main Plant
MW003M	575.18																						
MW040D	542.99	17.6	-0.045	Down	0.015	Up	0.060	Up	-0.012	Down	0.005	Up	No Data	NA	0.108	Up	0.019	Up	0.113	Up	0.001	Up	Main Plant
MW040M-R	560.56																						
MW100D	530.36	24.3	-0.016	Down	-0.026	Down	-0.007	Down	-0.014	Down	-0.017	Down	-0.011	Down	-0.022	Down	-0.002	Down	-0.018	Down	-0.008	Down	Wetland
MW100M	554.7																						
MW102D	536.92	22.2	-0.143	Down	-0.140	Down	-0.076	Down	-0.094	Down	-0.080	Down	-0.078	Down	-0.069	Down	-0.045	Down	-0.067	Down	-0.045	Down	Main Plant
MW102M	559.1																						
MW013D	544.31	13.3	-0.129	Down	0.254	Up	-0.090	Down	-0.112	Down	-0.098	Down	-0.105	Down	-0.102	Down	-0.074	Down	-0.115	Down	-0.095	Down	Upgradient/ Administration Building
MW013M	557.59																						

Notes:

All May 2014 measurements are from the May 19, 2014 event.

All December 2014 measurements are from the December 31, 2014 event.

All June 2015 measurements are from the June 24, 2015 event

All December 2015 measurements are from the December 8, 2015 event

All April 2016 measurements are from the April 30, 2016 event

All October 2016 measurements are from the October 18, 2016 event

All April 2017 measurements are from the April 24, 2017 event

All October 2017 measurements are from the October 11, 2017 event

April 2018 measurements are from Arpil 25 and 26, however, had the following issues: MW022M well was frozen during initial round, measurement shown is from 5/9/18; MW045S was frozen during initial round, measurement shown is from 5/3/18; MW100D, MW100M, MW100S were under standing water and water level could not be collected, measurements shown are from 5/8/18; MW105D, MW105M, MW105S water was to top of casing, water elevations are likely attributable to a water main break in the area; MW117D, MW117M and MW117S were frozen during the initial round, measurements shown are from 5/7/18 or 5/3/18; MW118D, MW118M and MW118S were covered with snow during the initial round, measurements shown are from 5/3/18.

Hydraulic gradient calculated by (Hydraulic Head $_{deeper}$-Hydraulic Head $_{shallower}$) /(Vertical Distance Between Mid-point of Well Screens)

-- = not applicable

ID = identification

ft = feet

ft amsl = feet above mean sea level in Wisconsin State Plane Coordinate System NAVD1988

Table 8. Monitoring Well Vertical Gradients – Inside Barrier Wall
Tyco Fire Products LP, Marinette, Wisconsin

Monitoring Well ID	Middle of PVC Screen Elevation (ft amsl)	Distance Between Middle of Well Screens (ft)	May 2014 Vertical Gradient (ft/ft)	May 2014 Vertical Gradient Direction	December 2014 Vertical Gradient (ft/ft)	December 2014 Vertical Gradient Direction	June 2015 Vertical Gradient (ft/ft)	June 2015 Vertical Gradient Direction	December 2015 Vertical Gradient (ft/ft)	December 2015 Vertical Gradient Direction	April 2016 Vertical Gradient (ft/ft)	April 2016 Vertical Gradient Direction	October 2016 Vertical Gradient (ft/ft)	October 2016 Vertical Gradient Direction	April 2017 Vertical Gradient (ft/ft)	April 2017 Vertical Gradient Direction	October 2017 Vertical Gradient (ft/ft)	October 2017 Vertical Gradient Direction	April-May 2018 Vertical Gradient (ft/ft)	April-May 2018 Vertical Gradient Direction	September 2018 Vertical Gradient (ft/ft)	September 2018 Vertical Gradient Direction	Containment Area
Medium Depth (M) to Shallow Depth (S)																							
MW004M	561.71	18.88	-0.010	Down	-0.007	Down	0.000	Flat	--	--	--	--	--	--	-0.017	Down	--	--	--	--	--	--	Main Plant
MW004S	580.59																						
MW009M	555.52	18.48	-0.002	Down	0.021	Up	-0.034	Down	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Main Plant
MW009S	574.00																						
MW041M	555.60	19.13	-0.002	Down	--	--	-0.016	Down	0.006	Up	-0.007	Down	-0.007	Down	-0.005	Down	-0.004	Down	-0.010	Down	-0.009	Down	Main Plant
MW041S	574.73																						
MW042M	557.31	17.42	-0.018	Down	-0.009	Down	0.009	Up	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Main Plant
MW042S	574.73																						
MW046M	554.84	17.99	--	--	--	--	0.009	Up	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Wetland
MW046S	572.83																						
MW047M	554.31	18.02	0.014	Up	-0.008	Down	0.021	Up	-0.117	Down	-0.036	Down	0.006	Up	-0.045	Down	0.017	Up	-0.044	Down	0.022	Up	Wetland
MW047S	572.33																						
MW064M	568.80	10.22	0.016	Up	-0.003	Down	0.005	Up	-0.094	Down	0.015	Up	0.015	Up	0.022	Up	0.024	Up	0.021	Up	0.037	Up	Main Plant
MW064S	579.02																						
MW101M	555.62	17.53	0.014	Up	0.012	Up	0.014	Up	0.021	Up	0.006	Up	0.015	Up	0.003	Up	0.014	Up	0.006	Up	0.014	Up	Wetland
MW101S	573.15																						
MW103M	559.14	17.35	-0.010	Down	0.028	Up	-0.004	Down	-0.004	Down	-0.022	Down	0.000	Flat	-0.014	Down	-0.011	Down	-0.039	Down	0.002	Up	Main Plant
MW103S	576.49																						
MW105M	555.37	17.51	-0.076	Down	0.003	Up	-0.021	Down	-0.012	Down	-0.012	Down	0.024	Up	0.024	Up	0.026	Up	0.001	Up	-0.017	Down	Main Plant
MW105S	572.88																						
MW106M	556.89	17.43	0.083	Up	-0.011	Down	-0.018	Down	0.012	Up	0.007	Up	-0.008	Down	-0.015	Down	-0.010	Down	0.041	Up	-0.005	Down	Main Plant
MW106S	574.32																						
MW108M	556.84	17.41	0.011	Up	0.058	Up	0.001	Up	0.004	Up	0.001	Up	-0.008	Down	0.008	Up	0.001	Up	-0.005	Down	-0.001	Down	Main Plant
MW108S	574.25																						
MW109M	555.36	17.37	0.004	Up	0.004	Up	0.008	Up	-0.004	Down	0.005	Up	-0.002	Down	-0.005	Down	-0.005	Down	-0.005	Down	-0.004	Down	Wetland
MW109S	572.73																						
MW045M	555.58	18.07	-0.001	Down	--	--	0.006	Up	0.014	Up	--	--	-0.016	Down	0.019	Up	0.007	Up	0.018	Up	0.002	Up	Main Plant
MW045S	573.65																						
MW115S	568.34	9.15	-0.029	Down	--	--	0.028	Up	-0.063	Down	-0.063	Down	-0.084	Down	-0.047	Down	-0.016	Down	-0.519	Down	-0.033	Down	Salt Vault
MW115P	577.49																						
MW117M	560.41	12.34	--	--	--	--	--	--	0.008	Up	0.006	Up	0.011	Up	-0.036	Down	0.011	Up	0.005	Up	0.016	Up	Main Plant
MW117S	572.75																						
MW118M	565.78	8.47	--	--	--	--	--	--	0.003	Up	0.008	Up	0.005	Up	0.130	Up	0.014	Up	0.017	Up	0.020	Up	Main Plant
MW118S	574.25																						
MW120M	558.51	16.63	--	--	--	--	--	--	0.007	Up	0.011	Up	0.003	Up	0.001	Up	0.010	Up	-0.033	Down	-0.013	Down	8th Street Slip
MW120S	575.14																						
Bedrock (D) to Medium Depth (M)																							
MW042D	537.27	20.04	0.038	Up	0.037	Up	0.088	Up	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Main Plant
MW042M	557.31																						
MW046D	529.60	25.24	--	--	--	--	0.014	Up	--	--	--	--	--	--	--	--	--	--	--	--	--	--	Wetland
MW046M	554.84																						
MW047D	529.60	24.71	-0.006	Down	-0.015	Down	0.009	Up	0.016	Up	-0.013	Down	0.044	Up	-0.018	Down	0.008	Up	-0.016	Down	0.016	Up	Wetland
MW047M	554.31																						
MW064D	535.26	33.54	-0.091	Down	-0.089	Down	-0.040	Down	-0.035	Down	-0.056	Down	-0.036	Down	-0.072	Down	-0.030	Down	-0.099	Down	-0.031	Down	Main Plant
MW064M	568.80																						
MW105D	543.30	12.07	0.084	Up	0.192	Up	0.022	Up	-0.042	Down	-0.058	Down	0.040	Up	0.013	Up	0.030	Up	0.022	Up	0.009	Up	Main Plant
MW105M	555.37																						
MW106D	541.82	15.07	-0.006	Down	-0.067	Down	0.043	Up	0.029	Up	0.012	Up	-0.050	Down	-0.062	Down	-0.022	Down	-0.087	Down	-0.063	Down	Main Plant
MW106M	556.89																						
MW108D	536.53	20.31	-0.089	Down	-0.018	Down	-0.023	Down	-0.035	Down	-0.034	Down	-0.053	Down	-0.061	Down	-0.045	Down	-0.078	Down	-0.032	Down	Main Plant
MW108M	556.84																						
MW107D	533.98	32.81	--	--	--	--	--	--	--	--	--	--	-0.012	Down	-0.020	Down	-0.014	Down	-0.035	Down	-0.016	Down	Main Plant
MW107M	566.79																						
MW109D	534.50	20.86	-0.007	Down	-0.059	Down	0.005	Up	0.035	Up	-0.047	Down	0.000	Flat	-0.058	Down	0.010	Down	-0.053	Down	0.011	Up	Wetland
MW109M	555.36																						
MW117D	533.52	26.89	--	--	--	--	--	--	-0.006	Down	-0.002	Down	-0.027	Down	-0.024	Down	-0.018	Down	-0.078	Down	-0.027	Down	Main Plant
MW117M	560.41																						

Table 8. Monitoring Well Vertical Gradients – Inside Barrier Wall
Tyco Fire Products LP, Marinette, Wisconsin

Monitoring Well ID	Middle of PVC Screen Elevation (ft amsl)	Distance Between Middle of Well Screens (ft)	May 2014 Vertical Gradient (ft/ft)	May 2014 Vertical Gradient Direction	December 2014 Vertical Gradient (ft/ft)	December 2014 Vertical Gradient Direction	June 2015 Vertical Gradient (ft/ft)	June 2015 Vertical Gradient Direction	December 2015 Vertical Gradient (ft/ft)	December 2015 Vertical Gradient Direction	April 2016 Vertical Gradient (ft/ft)	April 2016 Vertical Gradient Direction	October 2016 Vertical Gradient (ft/ft)	October 2016 Vertical Gradient Direction	April 2017 Vertical Gradient (ft/ft)	April 2017 Vertical Gradient Direction	October 2017 Vertical Gradient (ft/ft)	October 2017 Vertical Gradient Direction	April-May 2018 Vertical Gradient (ft/ft)	April-May 2018 Vertical Gradient Direction	September 2018 Vertical Gradient (ft/ft)	September 2018 Vertical Gradient Direction	Containment Area
MW118D	532.88	32.90	--	--	--	--	--	--	-0.243	Down	-0.008	Down	--	--	0.037	Up	-0.019	Down	-0.053	Down	--	--	Main Plant
MW118M	565.78																						
MW119D	527.84	40.50	--	--	--	--	--	--	--	--	-0.131	Down	0.081	Up	-0.099	Down	-0.030	Down	0.069	Up	-0.002	Down	Salt Vault
MW115S	568.34																						
MW120D	531.83	26.68	--	--	--	--	--	--	-0.079	Down	-0.073	Down	0.171	Up	0.258	Up	0.052	Up	0.011	Up	0.219	Up	8th Street Slip
MW120M	558.51																						

Notes:
All May 2014 measurements are from the May 19, 2014 event
All December 2014 measurements are from the December 31, 2014 event
All June 2015 measurements are from the June 24, 2015 event
All December 2015 measurements are from the December 8, 2015 event
All April 2016 measurements are from the April 30, 2016 event
All October 2016 measurements are from the October 18, 2016 event
All April 2017 measurements are from the April 24, 2017 event
October 2017 measurements are from the October 11, 2017 event (MW045S and MW045M were collected on November 1, 2017)
April 2018 measurements are from April 25 and 26, however, had the following issues: MW022M well was frozen during initial round, measurement shown is from 5/9/18; MW045S was frozen during initial round, measurement shown is from 5/3/18; MW100D, MW100M, MW100S were under standing water and water level could not be collected, measurements shown are from 5/8/18; MW105D, MW105M, MW105S water was to top of casing, water elevations are likely attributable to a water main break in the area; MW117D, MW117M and MW117S were frozen during the initial round, measurements shown are from 5/7/18 or 5/3/18; MW118D, MW118M and MW118S were covered with snow during the initial round, measurements shown are from 5/3/18.

Hydraulic gradient calculated by (Hydraulic $Head_{deeper}$-Hydraulic $Head_{shallower}$) /(Vertical Distance Between Mid-point of Well Screens)
*MW119D - groundwater recharge into monitoring well is slow due to bedrock conditions and therefore considered dry as part of this evaluation
-- = not applicable
ID = identification
ft = feet
ft amsl = feet above mean sea level in Wisconsin State Plane Coordinate System NAVD1988

Table 9. 2009 "Baseline" Event and 2011-2018 Barrier Wall Groundwater Monitoring Total Arsenic Sampling Results

Tyco Fire Products LP, Marinette, Wisconsin

Location	October 2009 Total Arsenic (ug/L)	Q	June 2011 Total Arsenic (ug/L)	Q	March 2012 Total Arsenic (ug/L)	Q	June 2012 Total Arsenic (ug/L)	Q	May 2013 Total Arsenic (ug/L)	Q	May 2014 Total Arsenic (ug/L)	Q	June/July 2015 Total Arsenic (ug/L)	Q	December 2015 Total Arsenic (ug/L)	Q	May 2016 Total Arsenic (ug/L)	Q	October 2016 Total Arsenic (ug/L)	Q	April 2017 Total Arsenic (ug/L)	Q	October 2017 Total Arsenic (ug/L)	Q	May 2018 Total Arsenic (ug/L)	Q	September 2018 Total Arsenic (ug/L)	Q
MW003D			1,200		213		202		99	J	79	JB	90		90	JB	83		89	JB*	86		83		86	JB	91	JB
MW003M			379				293		240	J*	240	JB*	270		260		340		290		260		310		230	JB	260	
MW003S			1,110				1,280		620		1,100		720		1,600		570	*	1,800		310		1,300		200	JB	1,300	
MW006M	191,000																											
MW006S	7,680																											
MW009M	50																											
MW009S	480	J																										
MW010M	114,000																											
MW010S	246,000																											
MW013D	3.5	J	20	UB	4.7	U	20	UB	2.6	U	2.6	U	11															
MW013M	3.3	J																										
MW013S	3.6	J																										
MW020M	4,990,000																											
MW020S	139,000																											
MW021M			10	J			4.7	U	3.7	J	44	JB***	29		45	JB	4.8	J	29	JB	3.5	J	48		2.5	JB	45.0	
MW021S			429				452		49	*	NA	***	NA		Abandoned		Abandoned		Abandoned		Abandoned		Abandoned		Abandoned		Abandoned	
MW021S-R															59	JB	60		64	JB*	60		65	*	74	JB*	72	*
MW022M	3.8	U																										
MW022S	3.5	U																										
MW029M			1,240,000				1,180,000	*	NA		NA		NA															
MW029S			14,200				8,890		NA		NA		NA															
MW030M			3,190,000				3,080,000		NA		NA		NA															
MW030S			349,000				279,000		NA		NA		NA															
MW031M											1,700,000	**																
MW031S											11,000	**																
MW034M	2,840,000																											
MW034S	20,500																											
MW039M	660,000																											
MW039S	4,560																											
MW040D			20	UB	22.4		20	UB	31	J*	21	JB	23		36	JB	23		19		11		9.6		3.4	J	10	U
MW040M			274	B			216		360	J	120	JB	240		200		250		250		79		260		150		160	
MW040S			94.5	B			70.3		60	J	25	JB	87		140	J	47	*	17		17		30		37		110	J
MW041D	606		Dry				Dry		Dry		Dry		Dry		Abandoned		Abandoned		Abandoned		Abandoned		Abandoned					
MW041M	1,170,000		1,530,000				1,770,000		1,700,000		1,600,000		1,500,000		1,600,000		1,400,000		970,000		740,000		1,400,000		1,600,000		1,300,000	
MW041S	15,700		5,280				6,060		3,500		2,400		49,000	*	37,000		22,000		19,000		540		33,000		870		17,000	
MW042D	3	U	4.9	J*	6.5	J	20	UB*	10		2.6	U*	2.7	J*														
MW042M	17.6	U																										
MW042S	156																											
MW046D	9,560				8,760																							
MW046M	328,000																											
MW046S	117																											
MW047D			1,260		870		680		700		34	JB	300		310		260		260		230		220		160		230	
MW047M			295,000				3,810		18,000		2,600		400		97	JB	1,300		320		13,000		1,600		82,000		1,300	
MW047S			39.5	B			20	UB	14		31	JB*	51		45	JB	97		79	JB	350		280		290		120	
MW048M	33.8																											
MW048S	2.6	J																										
MW064D			1,470		451		506		410	J	330		330		440		530		540		610		630		740		860	
MW064M	733		1,670				5,590	*	5,600	J	5,300		6,000		5,100	J	6,300		7,500		3,300		39,000		160,000		320,000	
MW064S	371		192				478		320	J	360		250		400		420		640		700		780		1,100		2,000	
MW065D	200		1,560		195		326		NA		NA		NA															
MW065M	2,110																											
MW065S	2,750																											
MW100D			540		618		573		340		420		240		240		220		220		150		130		130		140	
MW100M			20	UB			4.7	U	2.6	U	2.6	U	2.5	U	15	JB	4.3	J	2.5	U	2.1	U	46	JB	2.1	U	2.1	U
MW100S			20	UB			197	*	240		140	JB*	97		44	JB	76		29	JB	94		71	*	120		91	
MW101M			9.2	J*			4.7	U	2.6	U	2.6	U	2.5	U	2.8	UB	3.2	J	2.5	U	2.1	U	2.1	U	2.1	U	2.1	U
MW101S			8.2	J			856		640	*	460		340		140	JB	220		190		91	*	99		85	JB	61	
MW102D			875		170		192		180	J	140	JB	170		190		190		160		130		140		72	JB	63	
MW102M			1,430				954		760	J	970		190		170		9.7		110	JB	8.7		270		5,800		350	
MW102S			43.4	B			74.9		41	J	53	JB	110		120	JB	75		130	JB	71		140	*	89	JB*	110	*
MW103M			360				69.3		37		22	JB	16		21	JB	16		32		12		19		80	JB	23	
MW103S			20	UB			4.7	U	26		30	JB*	10		21	JB	48		20		44		25		39	JB	39	
MW104M			20	UB			4.7	U	22		2.6	U	3.8	JB	12	JB	5		36	JB	2.1	U	2.3	J	3.4	JB	2.5	J
MW104S			20	UB*			20	UB	6.6	J	12	JB*	6.4		14	JB	6.3		40	JB	8.0	*	27		6.1	JB	27.0	*
MW105D			22.8	UB	14	J	20	UB	40	J	7.6	UB	9.8		200		9.2		2.5	U	9.1		8.9				21	U
MW105M			23.2	UB			4.7	U	11	J	2.6	U	2.5	U	19	JB*	4.7	J	3.7	J	2.6	J	5.8				58.0	J
MW105S			142	B			309		190	J	110	JB	200		20	JB*	290		250		100		370	*	280		360	
MW106D			2,820		752		809		390	J	430		440		410		390		320		310		270		250	JB	250	
MW106M			126	B			92		230	J	230	JB	210		200		100		170		110	*	190		230	JB	210	

Table 9. 2009 "Baseline" Event and 2011-2018 Barrier Wall Groundwater Monitoring Total Arsenic Sampling Results
Tyco Fire Products LP, Marinette, Wisconsin

	October 2009		June 2011		March 2012		June 2012		May 2013		May 2014		June/July 2015		December 2015		May 2016		October 2016		April 2017		October 2017		May 2018		September 2018	
Location	Total Arsenic (ug/L)	Q	Total Arsenic (ug/L)	Q	Total Arsenic (ug/L)	Q	Total Arsenic (ug/L)	Q	Total Arsenic (ug/L)	Q	Total Arsenic (ug/L)	Q	Total Arsenic (ug/L)	Q	Total Arsenic (ug/L)	Q	Total Arsenic (ug/L)	Q	Total Arsenic (ug/L)	Q	Total Arsenic (ug/L)	Q	Total Arsenic (ug/L)	Q	Total Arsenic (ug/L)	Q	Total Arsenic (ug/L)	Q
MW106S			637				972	*	730	J	1,100		700		1,200		750		610		410		500		480	J*	370	
MW107M															27,000		51,000		37,000	*	37,000		4,300		36,000		35,000	
MW107D			664	*	767		1,160		480		2,300		2,900	*	3,000		2,500		3,200		4,000		2,000	J	1,900		130	
MW108D			1,980		1,310		618		630		120	JB	1,800		1,800		180		750		1,000		950	*	440		460	
MW108M			136,000				295,000		280,000	J	150,000		160,000		160,000		170,000		140,000		150,000		110,000		81,000		77,000	
MW108S			149,000				106,000		86,000	*	26,000		69,000		43,000		31,000		62,000		13,000		35,000		29,000		49,000	
MW109D			54,200		34,600		33,800		14,000		14,000		24,000		47,000		33,000		22,000	*	19,000		11,000		8,300		6,900	
MW109M			814,000				1,410,000		1,800,000		1,600,000		1,400,000		760,000	*	1,600,000		1,300,000		1,600,000		1,900,000		2,000,000		1,900,000	
MW109S			5,010	*			8,380		1,500		150	JB	12,000		160,000		24,000		66,000	J	9,200	*	9,400	J	23,000		42,000	J
MW110D					3,020																							
MW111D					128,000																							
MW112D					2,310																							
MW115P [1]															420,000	J			20,000		2,500				2,500			
MW115S [1]															42,000	J			85,000	J	270,000				340,000	J		
MW117D															530		270		340		380		350		420		370	
MW117M															7,900		13,000		14,000		7,300		7,000		4,000		4,400	
MW117S															730		220		920		1,500		1,300		1,700		1,700	
MW118D															53,000	J	54,000		45,000		6,900	*	48		Frozen		Damaged	
MW118M															1,900	J	21,000		58,000		52,000		23,000		15,000		9,900	
MW118S															1,800	J	1,300		2,500		3,900		3,600	*	1,300		2,200	
MW119D [1]															Dry		Dry		39,000		150,000				190,000			
MW120D [1]															650,000	J			220		340				480,000			
MW120M [1]															2,600,000				5,700,000		1,700,000				4,200,000			
MW120S [1]															28,000	J			2,900		12,000	*			1,700			

Notes:
ug/L = micrograms per liter
Bolded Location is a network well for arsenic semi-annual sampling based on the 2011 Barrier Wall Groundwater Monitoring Plan (CH2M 2011)
Italicized Location is a network well for arsenic semi-annual sampling based on the 2015 Barrier Wall Groundwater Monitoring Plan (CH2M 2015)
Bolded Total Arsenic values indicate attainment or exceedance of the Wisconsin Administrative Code (WAC) NR 140 Preventative Action Limit (PAL) = 1 ug/L
Shaded Total Arsenic values indicate attainment or exceedance of the Wisconsin Administrative Code (WAC) NR 140 Enforcement Standard (ES) = 10 ug/L
Note that the PAL and ES apply to dissolved arsenic concentrations in groundwater
Dry = Well was dry at the time of sampling
NA = Not analyzed, well was inaccessible, abandoned or damaged at the time of sampling. Refer to Table 2 for current well status.
Blank cells indicate the well was not sampled
*The higher of the two values were utilized when a duplicate sample was collected
**MW031M and MW031S were sampled to replace MW030M and MW030S

***MW021M and MW021S were found to be silted in during the May 2014 event. Both wells were redeveloped, and MW021M was found to be in good condition while MW021S needed to be replaced. A sample was collected at MW021M after redevelopment; however, the water still contained high sediment after redevelopment and may not be representative.

[1] Annual sampling with baseline event occurring in fall 2015, with additional sampling in 2016, 2017, 2018, and 2023
2009 data is from the "baseline" event
Q - Qualifier
U - indicates the analyte was analyzed for but was not detected above the method detection limit.
UB - indicates the analyte was analyzed for but was reported as not detected above the laboratory reporting/quantitation limit. The analyte was detected in an associated field and/or laboratory blank sample.
B - indicates the analyte was positively identified in an associated field and/or laboratory blank and the report concentration is considered an estimated value due to blank contamination.
J - indicates the analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.

Table 10. 2011, 2012, 2013, 2014, 2015, 2016, 2017, and 2018 Sampling Event Summary for Total Arsenic

Tyco Fire Products LP, Marinette, Wisconsin

Description	June 2011	June 2012	May 2013	May 2014	June/July 2015	December 2015	May 2016	October 2016	April 2017	October 2017	May 2018	September 2018
Detection Frequency	39/48	36/48	40/43	37/44	39/42	52/53	48/48	51/54	51/54	47/48	49/51	43/47
Range of Detects (µg/L)	4.6 to 3,190,000	69.3 to 3,080,000	3.7 to 1,800,000	12 to 1,700,000	2.7 to 1,500,000	14 to 2,600,000	3.2 to 1,600,000	3.7 to 5,700,000	2.6 to 1,700,000	2.0 to 1,900,000	2.5 to 4,200,000	2.5 to 1,900,000
Median Concentration (µg/L) (M & S wells inside wall)	3,340 (1,154)	4,700 (2,391)	685	780	370	1,900	1,300	2,900	3,300	1,300	2,100	2,000
Average Concentration (µg/L) (M & S wells inside wall)	351,395 (209,585)	370,706 (239,826)	216,489	254,990	177,677	218,392	145,351	314,339	171,002	153,794	330,025.6	163,597
Median Concentration (µg/L) (M & S wells outside wall)	69	136	55	53	97	89.5	34.9	52	39	68	82	101
Average Concentration (µg/L) (M & S wells outside wall)	317	296	200	246	159	223	120.5	232	76	214	559	211
Median Concentration (µg/L) (Bedrock - D wells)	1,038	416	340	120	240	425	260	320	340	220	420	185
Average Concentration (µg/L) (Bedrock - D wells)	4,758	2,779	1,332	1,375	2,332	54,089	7,050	7,475	12,210	1,218	52,500	792
WDNR Preventative Action Limit (1 µg/L) for dissolved arsenic) exceedances	39/48	36/48	40/43	37/44	39/42	52/53	48/48	51/54	51/54	47/48	49/51	43/47
WDNR Enforcement Standard (10 µg/L for dissolved arsenic) exceedances	36/48	36/48	38/44	37/44	36/42	52/53	40/48	50/54	46/54	43/48	45/51	42/47

Notes:

Average and Median concentrations calculated using ½ detection limit for samples that were not detected above the method detection limit.

Higher of results retained for duplicate samples.

Concentrations in parentheses are the median and average concentration calculated without MW030M and MW030S results for comparison to later sampling events (MW030M and MW030S have significantly higher total arsenic concentrations and were removed and unable to be sampled in 2013 and 2014).

µg/L – micrograms per liter

M – Medium depth wells

S – Shallow depth wells

WDNR – Wisconsin Department of Natural Resources

Table 11. Mann-Kendall Trend Analysis Summary
Tyco Fire Products LP, Marinette, Wisconsin

Description	Number of Wells	Number of Wells with < 4 Results[1]	Number of Wells with 4+ Results[1]	Increasing Trend[2]	Decreasing Trend[2]	Stable[3]	No Significant Trend[4]
M wells inside barrier walls	13	0	13	3	2	6	2
S wells inside barrier walls	14	0	14	6	3	3	2
M wells outside barrier walls	6	0	6	0	0	3	3
S wells outside barrier walls	6	0	6	2	0	3	1
D wells (all bedrock wells)	15	1	14	1	7	4	2
Totals	54	1	53	12	12	19	10

Notes:

[1] At least 4 results required to assess trends

[2] At 95 percent confidence level that trend is statistically significant

[3] Wells without significant increasing or decreasing trend and with coefficient of variation less than 1.0

[4] Wells without significant increasing or decreasing trend and with coefficient of variation greater than 1.0

M – Medium depth wells

S – Shallow depth wells

D – Bedrock wells

Table 12. Volatile Organic Compound
Analytical Data - Groundwater
Tyco Fire Products LP, Marinette, Wisconsin

			WELL IDENTIFICATION												
	WDNR	WDNR	MW041S	MW041S-D	MW041S			MW041M				MW045S			
VOCs (µg/L)	PAL	ES	9/21/2000	9/21/2000	10/29/2009	12/18/2015	5/3/2018**	9/21/2000	10/29/2009	12/18/2015	5/3/2018	9/21/2000	10/29/2009	12/12/2015	5/3/2018
Benzene	0.5	5	37 U	37 U	**24** J	**48**	**48** J	**0.59** J	4.1 U	**6.8**	**5.6** J	**45** J	**52.8**	**83** J	**76**
Chlorobenzene	20	100	**440**	**440**	**667**	**1,900**	**1,500** J	0.38 UR	4.1 U	3.5	3.3 J	**950**	**2,880**	**3,800** J	**3,800**
Chloroform	0.6	6	35 U	35 U	52 U	1.9 U	7.4 UJ	0.35 UR	13 U	0.37 U	0.37 UJ	17 U	32.5 U	1.9 UJ	7.4 U
1,2-Dichlorobenzene	60	600	**270**	**270**	**242**	**760**	**170** J	0.35 UR	8.3 U	0.33 U	0.33 UJ	**1,400**	**1,690**	**1,200** J	**1,800**
1,3-Dichlorobenzene	120	600	41 U	41 U	34.8 U	5	8 UJ	0.41 UR	8.7 U	0.4 U	0.40 UJ	20 U	21.8 U	8.4 J	13 J
1,4-Dichlorobenzene	15	75	38 U	38 U	38 U	**50**	**24** J	0.38 UR	9.5 U	0.36 U	0.36 UJ	**46** J	**68**	**64** J	**84**
Dichlorodifluoromethane	200	1,000	33 U	33 U	39.6 U	3.4 U	13 UJ	0.33 UR	9.9 U	0.67 U	0.67 UJ	17 U	24.8 U	3.4 UJ	13 U
1,1-Dichloroethane	85	850	35 U	35 U	30 U	2.1 U	8.2 UJ	0.35 UR	7.5 U	2.5	2.2 J	18 U	18.8 U	2.1 UJ	8.2 U
1,2-Dichloroethane	0.5	5	42 U	42 U	14.4 U	2 U	7.8 UJ	0.42 UR	3.6 U	0.39 U	0.39 UJ	21 U	9 U	2 UJ	**18** J
1,1-Dichloroethene	0.7	7	34 U	34 U	22.8 U	2 U	7.8 UJ	0.34 UR	5.7 U	0.63 J	0.66 J	17 U	14.2 U	2 UJ	7.8 U
cis-1,2-Dichloroethene	7	70				**13**	8.2 UJ			**59**	**45** J			**350** J	**390**
trans-1,2-Dichloroethene	20	100	37 U	37 U	35.6 U	1.7 U	7 UJ	0.37 UR	8.9 U	0.35 U	0.35 UJ	18 U	22.2 U	5.5 J	7.0 U
Isopropyl ether						1.4 U	5.5 UJ			0.28 U	0.91 J			1.4 UJ	5.5 U
Ethylbenzene	140	700	**1,100**	**1,100**	**1,920**	**4,000**	**1,500** J	0.43 UR	5.4 U	1.3	1.6 J	**300**	**935**	**700** J	**1,200**
Isopropylbenzene						12	9.2 J			0.39 U	0.39 UJ			1.9 UJ	7.7 U
p-Isopropyltoluene						18	7.2 UJ			0.51 J	0.59 J			9.4 J	8.5 J
Methylene Chloride	0.5	5	**560**	**570**	**57.1**	**26** JB	33 UJ	**2.1** J	**58.1**	**150**	**120** J	**560**	**129**	**35** JB	**110**
Methyl tert-butyl ether	12	60				2 U	7.9 UJ			0.39 U	0.39 UJ			2 UJ	7.9 U
Naphthalene	10	100	58 U	58 U	35.6 U	**26**	6.7 UJ	0.58 UR	8.9 U	1.5	0.34 UJ	29 U	**27.7** J	**16** J	**26**
Toluene	160	800	**6600**	**5700**	**4,310**	**370**	52 J	1.7 J	11.2	130	120 J	**2,500**	**4,310**	**1,800** J	**3,900**
Trichloroethene	0.5	5	**170**	**170**	**31** J	**7.7**	3.3 UJ	0.33 UR	**17.3**	**110**	**93** J	**380**	**184**	**58** J	**56**
1,2,4-Trimethylbenzene	96	480				1.8 U	7.2 UJ		9.7 U	0.36 U	0.36 UJ			4.5 J	7.2 U
1,3,5-Trimethylbenzene	96	480				1.3 U	5.1 UJ			0.25 U	0.25 UJ			1.3 UJ	5.1 U
Vinyl chloride	0.02	0.2	**40** J	**39** J	7.2 U	**5.3**	4.1 UJ	**1.7** J	**5.9** J	**17**	**13** J	**37** J	**22.1** J	**27** J	**32**
Xylenes, Total*	400	2,000	**5,000**	**4,900**	**10,590**	**23,000** J	**9,100** J	7.7 J	18 U	5.9	8.2 J	**990**	**6,010**	**4,100** J	**7,600**
Carbon disulfide	200	1,000	34 U	34 U	26.4 U	2.2 U	9.0 UJ	0.34 UR	6.6 U	0.83 J	1.0 J	17 U	16.5 U	2.2 UJ	9.0 U
1,4-Dioxane	0.3	3			4130 U	210 U	820 UJ		1030 U	41 U	**55** J		2580 U	210 UJ	820 U
2-Hexanone			45 U	45 U	78.8 U	7.8 U	31 UJ	0.45 UR	19.7 U	1.6 U	2.4 J	22 U	49.2 U	7.8 UJ	31 U
Acetone	1,800	9,000	**5,700**	**5,800**	469 J	**2,600**	35 UJ	11 UR	618	790	1,300 J	550 U	**4,640**	710 J	**3,900**
4-Methyl-2-pentanone (MIBK)	50	500	**4,100**	**4,100**	**965**	**280**	43 J	13 J	**742**	**790**	**1,100** J	**2,500**	**436**	**50** J	**130**
Acetonitrile			280 U	280 U	132 U	21 U	83 UJ	4.5 J	33 U	19	4.2 UJ	140 U	82.5 U	21 UJ	83 U
2-Butanone (MEK)	800	4,000	180 U	180 U	172 U	46	42 UJ	7.1 J	43 U	29	39 J	89 U	108 U	11 UJ	130
Iodomethane			31 U	31	100 U	3.3 U	13 UJ	0.31 UR	25 U	0.66 U	0.66 UJ	16 U	62.5 U	3.3 UJ	13 U

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Table 12. Volatile Organic Compound
Analytical Data - Groundwater
Tyco Fire Products LP, Marinette, Wisconsin

			WELL IDENTIFICATION												
	WDNR	WDNR	MW045M				MW108S		MW108S-D	MW108M		MW117S		MW117M	
VOCs (µg/L)	PAL	ES	9/21/2000	10/29/2009	12/11/2015	5/3/2018	12/18/2015	5/3/2018	12/18/2015	12/18/2015	5/3/2018	12/12/2015	5/3/2018	12/12/2015	5/7/2018
Benzene	0.5	5	**5.2** J	**9.3** J	**16** J	**27** J	**76**	**100**	**80**	**110**	**100** J	**16** J	**15**	**12** J	**24**
Chlorobenzene	20	100	15	**26.4**	**120** J	**240** J	**83**	**100**	**90**	**76**	**180** J	**310** J	**260**	**200** J	**540**
Chloroform	0.6	6	3.5 U	13 U	0.74 UJ	1.9 UJ	0.37 U	1.9 U	0.37 U	0.37 U	3.7 UJ	**1.3** J	0.37 U	0.37 UJ	0.74 U
1,2-Dichlorobenzene	60	600	15	10.9	**100** J	**240** J	48	**110**	50	**79**	**91** J	29 J	21	8.5 J	52
1,3-Dichlorobenzene	120	600	4.1 U	8.7 U	0.8 UJ	2.0 UJ	0.4 U	2.0 U	0.4 U	0.4 U	4.0 UJ	0.4 UJ	0.40 U	0.4 UJ	0.80 U
1,4-Dichlorobenzene	15	75	3.8 U	9.5 U	1.4 J	1.8 UJ	0.36 U	1.8 U	0.36 U	0.36 U	3.6 UJ	0.36 UJ	1.9	1.1 J	2.0
Dichlorodifluoromethane	200	1,000	3.3 U	9.9 U	1.3 UJ	3.4 UJ	0.67 U	8.0 J	0.67 U	1.4 J	6.7 UJ	0.67 UJ	0.67 U	0.67 UJ	1.3 U
1,1-Dichloroethane	85	850	3.5 U	7.5 U	4.2 J	7.2 J	0.41 U	2.1 U	0.41 U	0.41 U	4.1 UJ	0.41 UJ	0.41 U	0.41 UJ	0.82 U
1,2-Dichloroethane	0.5	5	4.2 U	3.6 U	0.78 UJ	2.0 UJ	0.39 U	2.0 U	0.39 U	**4**	3.9 UJ	0.39 UJ	0.39 U	0.39 UJ	0.78 U
1,1-Dichloroethene	0.7	7	3.4 U	5.7 U	**2.7** J	**3.9** J	0.39 U	2.0 U	0.39 U	0.39 U	3.9 UJ	0.39 UJ	0.39 U	0.39 UJ	0.78 U
cis-1,2-Dichloroethene	7	70			**220** J	**320** J	0.41 U	2.0 U	0.41 U	0.41 U	4.1 UJ	5 J	2.0	0.7 J	**7.4**
trans-1,2-Dichloroethene	20	100	3.7 U	8.9 U	0.7 UJ	1.7 UJ	0.35 U	1.7 U	0.35 U	0.35 U	3.5 UJ	1.1 J	0.94 J	0.35 UJ	1.8 J
Isopropyl ether					1.6 J	2.1 J	0.28 U	1.4 U	0.28 U	0.28 U	2.8 UJ	0.63 J	1.2	0.85 J	1.2 J
Ethylbenzene	140	700	4.3 U	5.4 U	9 J	17 J	5.7	8.8	6	7.2	9.9 J	22 J	4.3	0.8 J	40
Isopropylbenzene					0.77 UJ	1.9 UJ	0.39 U	1.9 U	0.39 U	0.39 U	3.9 UJ	0.39 UJ	0.52 J	0.56 J	0.77 U
p-Isopropyltoluene					0.72 UJ	1.8 UJ	7.9	14	8.5	9	8.6 J	22 J	8.0	47 J	18
Methylene Chloride	0.5	5	**91**	**63.7**	**80** J	**100** J	**5.1** JB	8.2 U	**5.2** JB	**15** JB	**16** UJ	1.6 UJ	**4.4** J	1.6 UJ	3.3 U
Methyl tert-butyl ether	12	60			0.79 UJ	2.0 UJ	0.6 J	2.0 U	0.64 J	0.39 U	3.9 UJ	0.39 UJ	0.39 U	0.39 UJ	0.79 U
Naphthalene	10	100	5.8 U	8.9 U	0.67 UJ	1.7 UJ	**58**	**140**	**65**	**170**	**150** J	1.4 J	0.34 U	0.34 UJ	1.5 J
Toluene	160	800	36	53.4	140 J	**270** J	3.5	7.5	3.7	9.4	9.9 J	48 J	17	3.1 J	64
Trichloroethene	0.5	5	**250**	**681**	**840** J	**1,700** J	0.26 J	0.82 U	0.25 J	0.16 U	1.6 UJ	**0.97** J	0.16 U	0.16 UJ	**1.4**
1,2,4-Trimethylbenzene	96	480		9.7 U	0.72 UJ	1.8 UJ	2.7	5.7	2.9	3.9	3.6 UJ	1.1 J	0.36 U	0.36 UJ	1.1 J
1,3,5-Trimethylbenzene	96	480			0.51 UJ	1.3 UJ	1.8	3.9 J	1.9	2.8	2.5 UJ	0.25 UJ	0.25 U	0.25 UJ	0.51 U
Vinyl chloride	0.02	0.2	**17**	**36.8**	**42** J	**54** J	0.2 U	1.0 U	0.2 U	0.2 U	2.0 UJ	**1.9** J	**0.97** J	0.2 UJ	**3.5**
Xylenes, Total*	400	2,000	7.8 U	18 U	48 J	92 J	23	47	24	32	32 J	88 J	13	6.5 J	180
Carbon disulfide	200	1,000	13	6.6 U	1.6 J	2.2 UJ	0.45 U	2.2 U	0.45 U	0.87 J	4.5 UJ	4.6 J	0.45 U	0.45 UJ	2.6 J
1,4-Dioxane	0.3	3		1030 U	82 UJ	210 UJ	41 U	210 U	41 U	41 U	410 UJ	41 UJ	41 U	41 UJ	82 U
2-Hexanone			4.5 U	19.7 U	3.1 UJ	7.8 UJ	1.6 U	7.8 U	1.6 U	1.6 U	16 UJ	1.6 UJ	1.6 U	1.6 UJ	3.1 U
Acetone	1,800	9,000	110 U	714	520 J	1,500 J	27	120	28	75	320 J	63 J	1.7 U	8.2 J	100
4-Methyl-2-pentanone (MIBK)	50	500	**680**	**799**	**570** J	**1,200** J	2.2 U	11 U	2.2 U	2.2 U	22 UJ	45 J	2.2 U	2.2 UJ	57
Acetonitrile			28 U	33 U	37 J	21 UJ	4.2 U	21 U	4.2 U	15	42 UJ	4.2 UJ	4.2 U	4.2 UJ	8.3 U
2-Butanone (MEK)	800	4,000	56 J	52.6 J	4.2 UJ	11 UJ	2.1 U	11 U	2.1 U	2.1 U	21 UJ	5.4 J	2.1 U	2.1 UJ	4.2 U
Iodomethane			3.1 U	25 U	1.3 UJ	3.3 UJ	0.66 U	3.3 U	0.66 U	0.66 U	6.6 UJ	0.66 UJ	0.66 U	0.66 UJ	1.3 U

Notes:
µg/L = micrograms per liter
WDNR PAL = Wisconsin Administrative Code (WAC) NR 140 Preventative Action Limit
WDNR ES = Wisconsin Administrative Code (WAC) NR 140 Enforcement Standard
J indicates the analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
U indicates the analyte was analyzed for but was not detected above the method detection limit.
R indicates rejected data. The presence or absence of the analyte cannot be verified.
Bolded values indicate attainment or exceedance of the Wisconsin Administrative Code (WAC) NR 140 Preventative Action Limit (PAL).
Bolded and shaded values indicate attainment or exceedance of WAC NR 140 Enforcement Standard
Blank cells indicate the well was not sampled for that compound
2009 data is from the "baseline" event
2000 data was collected by URS Corporation (URS) as part of the 2000 *RCRA Facility Investigation* (URS 2001)
*Xylenes, Total data for 2000 and 2009 are the sum of the meta-, ortho-, and para-xylene combined or the result of the detected result if the others were non-detect or the highest non-detect result if all were non-detect
**Max value between primary and duplicate samples was reported

Table 13. Yearly Summary of GWCTS Operations Data
Tyco Fire Products LP, Marinette, Wisconsin

Year	Operating Days	Precipitation (inches)	Reject Water Disposed/Produced (gallons)	Total Discharged (gallons)	Total Extracted (gallons)
2011	229	42.11	112,500	1,236,555	1,175,432
2012	287	19.74	726,490	4,255,797	5,320,594
2013	352	17.39	952800	6193141	6325553
2014	348	21.80	1,143,100	7,034,349	6,925,853
2015	341	28.20	1,148,250	6,410,807	6,451,891
2016	272	32.88	794,270	3,602,076	3,819,086
2017	214	37.56	700,450	2,718,076	2,950,009
2018 (first three quarters)	120	28.66	458,100	1,449,162	1,511,663

Notes:
GWCTS = groundwater collection and treatment system
Reject Water = concentrated liquid waste from the reverse osmosis process

Tabke 14. 2016-2018 Pump Down Program Groundwater Elevation Monitoring

Tyco Fire Products LP, Marinette, Wisconsin

Target Elevation	577.9

Well ID	June 14, 2016		June 16, 2016		June 22, 2016		June 29, 2016		July 6, 2016	
	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)
MW001M	3.38	583.64	3.37	583.65	3.29	583.73	10.39	576.62	8.94	578.07
MW001S	3.43	583.70	3.46	583.67	3.37	583.76	10.84	576.29	9.11	578.02
MW002M-R		-	3.5	583.88	3.36	584.02	10.16	577.09	8.92	578.36
MW002S-R		-	3.44	583.62	3.35	583.71	10.31	576.74	8.98	578.08
MW031M	4.29	583.60	4.21	583.68	4.21	583.68	10.82	577.03	10.07	577.79
MW031S	NM	-	1.80	583.79	1.85	583.74	8.52	577.06	6.99	578.60
MW113S		-	2.85	583.68	2.71	583.82	10.24	576.27	8.46	578.06
MW113M		-	3.5	582.98	3.52	582.96	7.61	578.87	6.9	579.58
MW115P	1.76	583.75	1.70	583.81	1.68	583.83	7.34	578.16	6.00	579.50
MW115S	NM	-	1.52	583.65	1.43	583.74	8.81	576.35	7.06	578.11
MW116P	1.58	584.77	2.63	583.71	2.57	583.77	4.09	582.25	5.34	580.99
MW116S	2.61	583.70	2.61	583.70	2.55	583.76	10.40	575.88	8.13	578.16
MW116D	NM	-	0.00	585.28	0.00	585.28	0.00	585.28	1.08	584.20
EW-3		-		-		-		-		-
EW-10		-		-		-	11.37	576.41	8.9	578.89
EW-11		-		-		-	12.12	575.21	8.46	578.87
EW-13		-		-		-	13.27	572.51	16.78	568.99
EW-14		-		-		-	12.6	574.15	7.81	578.97
MW034M	2.15	582.80	2.18	582.77	2.05	582.90	5.49	579.46	5.8	579.15
MW034S	2.00	582.83	2.05	582.78	1.81	583.02	5.43	579.39	5.87	578.95
MW036M	3.27	582.00	2.89	582.39	2.94	582.34	5.07	580.17	5.13	580.11
MW036S	2.33	582.64	2.36	582.61	2.23	582.74	4.25	580.72	4.5	580.47
MW038M		-	2.69	583.34	3.72	582.31	5.57	580.46	5.31	580.72
MW038S		-	3.69	582.34	3.73	582.30	5.67	580.36	5.32	580.71
MW120D		-	4.40	581.32	4.69	581.03	4.55	581.17	4.78	580.94
MW120M	2.53	583.01	2.56	582.98	2.44	583.10	3.90	581.62	4.44	581.07
MW120S		-	2.11	582.91	1.96	583.06	2.61	582.41	3.23	581.79
EW-2		-		-		-		-		-
EW-8		-		-		-	8.52	578.27	4.8	581.99
EW-9		-		-		-	12.74	572.96	13.74	571.95
MW004M		-		-		-		-		-
MW004S		-	3.98	582.94	4.05	582.87	3.91	583.01	4.19	582.73
MW032M	4.66	581.90		-	4.64	581.92	4.66	581.90	4.83	581.73
MW032S	6.91	579.77	4.82	581.87	3.99	582.70	3.76	582.93	4.03	582.66
MW033M	5.18	583.61		-	5.02	583.78	4.88	583.92	5.14	583.65
MW033S	4.71	582.46	4.36	582.81	4.51	582.66	4.33	582.84	4.67	582.50
MW039M		-		-		-		-		-
MW039S		-	3.09	582.99	3.14	582.94	3.03	583.05	3.3	582.78
MW035M	4.44	580.56		-		-		-		-
MW035S	3.75	580.57	2.58	581.74	3.32	581.00	2.80	581.52	3.54	580.78
MW037M		-		-		-		-		-
MW037S		-	2.14	581.88	3.07	580.95	2.29	581.73	3.31	580.71
SG4		-		-	8.05	580.72	8.00	580.67	8.38	581.05
Rough Target Elevation Calc SV*		583.66		583.63		583.69		576.82		578.28
Rough Target Elevation Calc 8S*		582.65		582.76		582.72		580.57		580.37
Target Elevation (NAVD88)		577.9		577.9		577.9		577.9		577.90
SV Variance		5.76		5.73		5.79		-1.08		0.38
8S Variance		4.75		4.86		4.82		2.67		2.47

Well ID	July 13, 2016		July 20, 2016		July 27, 2016		August 1, 2016		August 3, 2016		August 8, 2016	
	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)
MW001M	11.83	575.17	12.27	574.73	11.9	575.10	11.79	575.21	10.19	576.82	11.37	575.63
MW001S	12.12	575.01	11.76	575.37	11.19	575.94	11	576.13	10.39	576.74	10.53	576.60
MW002M-R	11.46	575.77	12.85	576.05	12.54	576.37	12.39	576.52	11.88	577.04	11.99	576.93
MW002S-R	11.56	575.49	12.9	575.81	12.63	576.08	12.46	576.25	11.95	576.76	11.98	576.73
MW031M	12.00	575.85	11.86	575.99	11.48	576.37	11.34	576.51	10.89	576.96	10.92	576.93
MW031S	9.24	576.34	10.7	576.56	9.48	577.78	9.32	577.94	9.19	578.07	9.48	577.78
MW113S	11.28	575.23	12.46	575.72	12.08	576.10	11.88	576.30	11.36	576.82	11.32	576.86
MW113M	8.57	577.90	10.1	578.04	9.97	578.17	10.88	577.26	9.21	578.94	9.26	578.89
MW115P	8.98	576.52	10.67	576.52	10.36	576.83	10.31	576.88	9.74	577.45	9.83	577.36
MW115S	9.65	575.51	11.04	575.77	10.75	576.06	10.61	576.20	9.96	576.85	10.18	576.63
MW116P	6.40	579.93	8.5	579.47	8.72	579.25	8.83	579.14	8.82	579.15	8.86	579.11
MW116S	10.76	575.51	12.12	575.83	11.82	576.13	11.64	576.31	11.09	576.86	11.13	576.82
MW116D	0.00	585.28	2.64	584.31	3.59	583.36	4.17	582.78	4.35	582.60	4.8	582.15
EW-3		-		-		-		-		-		-
EW-10	14.34	573.44	17.48	570.29	19.12	568.65	19.18	568.59	10.2	577.59	19.28	568.49
EW-11	15.9	571.42	18.31	569.01	18.41	568.91	18.8	568.52	9.62	577.71	9.62	577.71
EW-13	15.01	570.77	16.92	568.85	17.04	568.73	16.5	569.27	8.01	577.79	16.08	569.69
EW-14	16.26	570.48	17.96	568.77	18.57	568.16	18.93	567.79	9.13	577.64	9.12	577.65
MW034M	7.04	577.91	9.35	577.27	9.87	576.75	10.04	576.58	10.33	576.29	10.68	575.94
MW034S	7.07	577.75	9.41	577.08	9.8	576.69	9.94	576.55	10.25	576.24	10.57	575.92
MW036M	6.69	578.52	9.37	577.49	10.18	576.67	10.44	576.40	10.82	576.01	11.31	575.52
MW036S	5.97	578.99	7	577.96	7.83	577.13	8.23	576.73	8.56	576.40	9.07	575.89
MW038M	7.41	578.62	10.16	577.53	11.09	576.60	11.43	576.26	11.88	575.81	12.41	575.28
MW038S	7.55	578.48	10.35	577.36	11.36	576.34	11.72	575.98	12.12	575.58	12.69	575.01
MW120D	4.60	581.12	6.31	581.07	6.41	580.97	6.19	581.19	6.3	581.08	6.35	581.03
MW120M	5.48	580.01	8.09	579.05	8.66	578.47	9.04	578.09	9.26	577.86	9.66	577.46
MW120S	4.21	580.80	7	579.68	7.72	578.96	8.2	578.48	8.28	578.40	8.74	577.94
EW-2		-		-		-		-		-		-
EW-8	10.79	575.99	12.33	574.45	13.68	573.09	14.22	572.55	16.02	570.75	16.31	570.46
EW-9	13.72	571.98	15.21	570.48	15.57	570.12	14.88	570.81	15.19	570.50	15.83	569.86
MW004M		-		-		-		-		-		-
MW004S	4.34	582.58	6.17	582.41	6.29	582.29	6.37	582.21	6.4	582.18	6.59	581.99
MW032M	4.96	581.60	6.67	581.55	6.87	581.34	6.89	581.32	6.86	581.35	7.14	581.07
MW032S	3.96	582.73	5.73	582.63	5.79	582.57	5.81	582.55	6.04	582.32	6.42	581.94
MW033M	5.29	583.50	5.48	583.31	5.59	583.19	5.71	583.07	5.72	583.06	5.92	582.86
MW033S	4.75	582.42	4.94	582.23	5.08	582.09	5.15	582.02	5.21	581.96	5.39	581.78
MW039M		-		-		-		-		-		-
MW039S	3.45	582.63	5.28	582.45	5.43	582.30	5.5	582.23	5.51	582.22	5.72	582.01
MW035M		-		-		-		-		-		-
MW035S	3.71	580.61	5.66	580.34	6.01	579.99	6.19	579.81	6.37	579.63	6.84	579.16
MW037M		-		-		-		-		-		-
MW037S	3.56	580.46	5.49	580.20	5.82	579.87	6.04	579.65	6.21	579.48	6.67	579.02
SG4	8.03	580.64	8.2	580.47	8.15	580.52	8.02	580.65	8.05	580.62	8.07	580.60
Rough Target Elevation Calc SV*		575.78		575.99		576.41		576.46		577.19		576.98
Rough Target Elevation Calc 8S*		578.89		577.93		577.20		576.88		576.58		576.12
Target Elevation (NAVD88)		577.9		577.90		577.90		577.90		577.90		577.90
SV Variance		-2.12		-1.91		-1.49		-1.44		-0.71		-0.92
8S Variance		0.99		0.03		-0.70		-1.02		-1.32		-1.78

Well ID	August 10, 2016		August 11, 2016		August 13, 2016		August 17, 2016		August 20, 2016		August 22, 2016	
	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)
MW001M	11.32	575.69	11.16	575.85	11.1	575.91	11.05	575.96	10.87	576.14	10.95	576.06
MW001S	10.47	576.66	10.39	576.74	10.31	576.82	10.26	576.87	10.12	577.01	10.15	576.98
MW002M-R	11.88	577.04	11.69	577.24	11.72	577.21	11.65	577.28	11.49	577.44	11.59	577.34
MW002S-R	11.96	576.75	11.81	576.91	11.78	576.94	11.76	576.96	11.54	577.18	11.67	577.05
MW031M	10.85	577.00	10.79	577.06	10.69	577.16	10.65	577.20	10.51	577.34	10.59	577.26
MW031S	9.42	577.84	9.42	577.84	9.07	578.19	8.4	578.87	8.98	578.28	8.62	578.65
MW113S	11.32	576.86	11.17	577.01	11.15	577.03	11.12	577.07	10.93	577.26	11.01	577.18
MW113M	9.25	578.90	9.19	578.96	9.14	579.01	9.14	579.01	9.06	579.09	9.12	579.03
MW115P	9.86	577.33	9.76	577.43	9.72	577.47	9.71	577.48	9.51	577.68	9.56	577.63
MW115S	10.17	576.64	10.03	576.78	10	576.81	9.96	576.85	9.77	577.04	9.87	576.94
MW116P	8.9	579.07	8.84	579.13	8.89	579.08	8.94	579.03	8.88	579.09	8.96	579.01
MW116S	11.08	576.87	10.97	576.98	10.96	576.99	10.9	577.05	10.72	577.23	10.83	577.12
MW116D	4.96	581.99	5.04	581.91	5.16	581.79	5.4	581.55	5.56	581.39	5.65	581.30
EW-3		-		-		-		-		-		-
EW-10	18.77	569.00	19.29	568.48	17.35	570.42	19.56	568.21	19.42	568.35	19.68	568.09
EW-11	9.52	577.81	9.42	577.91	9.5	577.83	9.41	577.92	9.17	578.16	9.31	578.02
EW-13	16.36	569.41	16.61	569.16	17.45	568.32	17.57	568.20	15.43	570.35	17.17	568.60
EW-14	9.1	577.67	8.97	577.80	8.94	577.83	8.91	577.86	8.67	578.10	8.82	577.95
MW034M	9.32	577.30	9.16	577.46	9.3	577.32	9.41	577.21	9.44	577.18	9.62	577.00
MW034S	9.41	577.08	9.23	577.26	9.26	577.23	9.55	576.94	9.56	576.93	9.71	576.78
MW036M	10.6	576.24	10.38	576.46	10.91	575.92	11.23	575.60	11.27	575.56	11.38	575.44
MW036S	8.43	576.53	8.22	576.74	8.63	576.33	8.96	576.00	9.03	575.93	9.16	575.80
MW038M	11.53	576.16	11.26	576.43	12.06	575.63	12.44	575.25	12.53	575.16	12.64	575.05
MW038S	11.64	576.06	11.36	576.34	12.3	575.40	12.7	575.00	12.77	574.93	12.87	574.83
MW120D	6.58	580.80	6.45	580.93	6.37	581.01	6.43	580.95	6.29	581.09	6.44	580.94
MW120M	9.34	577.78	9.23	577.89	9.3	577.82	9.3	577.82	9.52	577.60	9.62	577.50
MW120S	8.75	577.93	8.59	578.09	8.63	578.05	8.85	577.83	8.74	577.94	8.99	577.69
EW-2		-		-		-		-		-		-
EW-8	9.32	577.46	8.99	577.79	16.35	570.42	17.52	569.25	17.14	569.63	16.82	569.95
EW-9	7.76	577.95	7.55	578.16	7.65	578.06	7.82	577.89	7.9	577.81	8.09	577.62
MW004M		-		-		-		-		-		-
MW004S	6.64	581.94	6.66	581.92	6.69	581.89	6.73	581.85	6.72	581.86	6.69	581.89
MW032M	7.18	581.03	7.16	581.05	7.06	581.15	7.06	581.15	6.94	581.27	7.04	581.17
MW032S	6.54	581.82	6.58	581.78	6.38	581.98	5.9	582.46	5.62	582.74	5.53	582.83
MW033M	5.98	582.80	5.98	582.80	5.96	582.82	6.02	582.76	5.96	582.82	5.94	582.84
MW033S	5.47	581.70	5.47	581.70	5.47	581.70	5.51	581.66	5.47	581.70	5.44	581.73
MW039M		-		-		-		-		-		-
MW039S	5.78	581.95	5.79	581.94	5.84	581.89	5.86	581.87	5.85	581.88	5.81	581.92
MW035M		-		-		-		-		-		-
MW035S	7.14	578.86	7.11	578.89	6.88	579.12	6.43	579.57	6.27	579.73	6.19	579.81
MW037M		-		-		-		-		-		-
MW037S	7.04	578.65	7.03	578.66	6.76	578.93	6.4	579.29	6.25	579.44	5.96	579.73
SG4	8.39	580.28	8.21	580.46	8.22	580.45	8	580.67	8.2	580.47	8.2	580.47
Rough Target Elevation Calc SV*		577.03		577.14		577.21		577.31		577.40		577.36
Rough Target Elevation Calc 8S*		576.89		577.09		576.71		576.46		576.40		576.26
Target Elevation (NAVD88)		577.90		577.90		577.90		577.90		577.90		577.90
SV Variance		-0.87		-0.76		-0.69		-0.59		-0.50		-0.54
8S Variance		-1.01		-0.81		-1.19		-1.44		-1.50		-1.64

Well ID	August 24, 2016		August 27, 2016		September 3, 2016		September 7, 2016	
	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)
MW001M	10.74	576.27	10.68	576.33	10.82	576.19	10.78	576.23
MW001S	9.99	577.14	9.96	577.17	9.93	577.20	9.9	577.23
MW002M-R	11.42	577.51	11.4	577.53	11.34	577.59	11.33	577.60
MW002S-R	11.46	577.26	11.45	577.27	11.42	577.30	11.4	577.32
MW031M	10.43	577.43	10.39	577.47	10.32	577.54	10.3	577.56
MW031S	8.18	579.09	8.35	578.92	9.09	578.17	9.78	577.48
MW113S	10.83	577.36	10.82	577.37	10.77	577.42	10.76	577.43
MW113M	9.01	579.14	8.99	579.16	8.96	579.19	8.98	579.17
MW115P	9.37	577.82	9.43	577.76	9.36	577.83	9.34	577.85
MW115S	9.65	577.16	9.65	577.16	9.64	577.17	9.61	577.20
MW116P	8.92	579.05	9.07	578.90	9.18	578.79	9.11	578.86
MW116S	10.62	577.33	10.6	577.35	10.59	577.36	10.58	577.37
MW116D	5.74	581.21	5.87	581.08	6.11	580.84	6.21	580.74
EW-3		-		-		-		-
EW-10	19.41	568.36	19.79	567.98	23.03	564.73	21.82	565.94
EW-11	9.14	578.19	9.13	578.20	9.1	578.23	9.08	578.25
EW-13	17.74	568.03	17.8	567.97	16.22	569.55	16.22	569.55
EW-14	8.61	578.16	8.73	578.04	8.63	578.14	8.59	578.18
MW034M	10.74	575.88	10.91	575.71	11.03	575.59	11.05	575.57
MW034S	10.65	575.84	10.86	575.63	10.97	575.52	10.99	575.50
MW036M	11.18	575.65	11	575.83	10.87	575.96	10.84	575.99
MW036S	9.03	575.93	8.85	576.11	8.78	576.18	8.74	576.22
MW038M	12.06	575.63	11.57	576.12	11.3	576.39	11.19	576.50
MW038S	12.19	575.51	11.61	576.09	11.33	576.37	11.26	576.44
MW120D	6.35	581.03	6.39	580.99	6.23	581.15	6.46	580.92
MW120M	9.84	577.27	10.04	577.07	10.37	576.74	10.44	576.66
MW120S	8.93	577.75	9.25	577.43	9.68	577.00	9.75	576.92
EW-2		-		-		-		-
EW-8	9.91	576.87	9.35	577.43	9.18	577.60	9.11	577.67
EW-9	16.49	569.20	16.35	569.34	16.24	569.45	16.6	569.09
MW004M		-		-		-		-
MW004S	6.61	581.97	6.56	582.02	6.78	581.80	6.86	581.72
MW032M	6.98	581.23	6.9	581.31	7.07	581.14	7.1	581.11
MW032S	5.55	582.81	5.53	582.83	5.93	582.43	6.18	582.18
MW033M	5.83	582.95	5.79	582.99	6.04	582.74	6.1	582.68
MW033S	5.34	581.83	5.31	581.86	5.53	581.64	5.59	581.58
MW039M		-		-		-		-
MW039S	5.69	582.04	5.68	582.05	5.9	581.83	5.99	581.74
MW035M		-		-		-		-
MW035S	5.91	580.09	6.07	579.93	6.62	579.38	6.83	579.17
MW037M		-		-		-		-
MW037S	5.79	579.90	5.83	579.86	6.41	579.28	6.64	579.05
SG4	8.12	580.55	8.15	580.52	8.06	580.61	8.14	580.53
Rough Target Elevation Calc SV*		577.57		577.57		577.51		577.46
Rough Target Elevation Calc 8S*		576.18		576.25		576.22		576.23
Target Elevation (NAVD88)		577.90		577.90		577.90		577.90
SV Variance		-0.33		-0.33		-0.39		-0.44
8S Variance		-1.72		-1.65		-1.68		-1.67

Well ID	September 10, 2016		September 14, 2016		September 17, 2016		September 21, 2016		September 24, 2016	
	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)
MW001M	10.6	576.41	10.7	576.31	10.88	576.13	10.99	576.02	11.08	575.93
MW001S	9.74	577.39	9.87	577.26	10.06	577.07	10.21	576.92	10.31	576.82
MW002M-R	11.18	577.76	11.3	577.63	11.55	577.38	11.71	577.22	11.78	577.14
MW002S-R	11.26	577.46	11.38	577.34	11.59	577.13	11.78	576.94	11.84	576.88
MW031M	10.2	577.66	10.3	577.56	10.43	577.43	10.59	577.26	10.67	577.18
MW031S	9.55	577.71	8.54	578.73	8.47	578.80	9.85	577.41	9.59	577.67
MW113S	10.61	577.58	10.73	577.46	11.06	577.13	11.2	576.98	11.28	576.90
MW113M	8.9	579.25	8.98	579.17	9.61	578.54	10.21	577.93	10.18	577.96
MW115P	9.2	577.99	9.32	577.87	9.33	577.86	9.52	577.67	9.57	577.62
MW115S	9.47	577.34	9.57	577.24	9.76	577.05	9.92	576.89	9.99	576.82
MW116P	9.02	578.95	9.27	578.70	9.14	578.83	9.41	578.56	9.64	578.33
MW116S	10.42	577.53	10.56	577.39	10.84	577.11	11.02	576.93	11.08	576.87
MW116D	6.26	580.69	6.37	580.58	6.43	580.52	6.52	580.43	6.55	580.40
EW-3		-		-		-		-		-
EW-10	23.65	564.11	22.14	565.62	23.27	564.49	23.52	564.24	22.68	565.08
EW-11	8.9	578.43	9.03	578.30	18.39	564.04	28.18	563.79	28.64	564.63
EW-13	24.55	561.19	23.95	561.80	16.27	567.38	17.88	557.55	23.63	557.09
EW-14	8.45	578.32	8.53	578.24	17.16	570.47	21.19	568.85	21.24	563.07
MW034M	10.98	575.64	11.11	575.51	11	575.62	11.03	575.59	11.14	575.48
MW034S	10.96	575.53	11.04	575.45	10.95	575.49	11.07	575.46	11.05	575.35
MW036M	10.65	576.19	10.87	575.96	10.75	576.09	10.89	575.94	10.89	575.94
MW036S	8.61	576.35	8.76	576.20	8.66	576.30	8.79	576.17	8.8	576.16
MW038M	10.86	576.83	11.17	576.52	11.07	576.62	11.22	576.47	11.19	576.50
MW038S	10.82	576.88	11.23	576.47	11.13	576.57	11.27	576.43	11.24	576.46
MW120D	6.19	581.19	6.62	580.76	6.49	580.89	6.51	580.87	6.44	580.94
MW120M	10.45	576.65	10.58	576.52	10.51	576.59	10.68	576.42	10.68	576.42
MW120S	9.68	577.00	9.99	576.68	9.79	576.88	10.1	576.57	10.13	576.54
EW-2		-		-		-		-		-
EW-8	8.33	578.46	9.1	577.68	8.99	577.79	9.16	577.62	9.51	577.27
EW-9	16.82	568.87	16.92	568.77	16.78	568.91	16.74	568.95	16.32	569.37
MW004M		-		-		-		-		-
MW004S	6.84	581.74	6.8	581.78	6.62	581.96	6.76	581.82	6.69	581.89
MW032M	7.08	581.13	7.04	581.17	6.84	581.37	7.09	581.12	6.9	581.31
MW032S	5.96	582.40	5.66	582.70	5.58	582.78	5.69	582.67	5.57	582.79
MW033M	6.07	582.71	6.05	582.73	5.82	582.96	6.01	582.77	5.94	582.84
MW033S	5.61	581.56	5.53	581.64	5.31	581.86	5.5	581.67	5.45	581.72
MW039M		-		-		-		-		-
MW039S	5.96	581.77	5.9	581.83	5.72	582.01	5.86	581.87	5.77	581.96
MW035M		-		-		-		-		-
MW035S	6.55	579.45	6.12	579.88	5.77	580.23	6.24	579.76	5.93	580.07
MW037M		-		-		-		-		-
MW037S	6.48	579.21	5.94	579.75	5.55	580.14	6	579.69	5.67	580.02
SG4	8.05	580.62	8.46	580.21	8.36	580.31	8.26	580.41	8.28	580.39
Rough Target Elevation Calc SV*		577.61		577.61		577.37		577.05		577.02
Rough Target Elevation Calc 8S*		576.38		576.17		576.27		576.13		576.11
Target Elevation (NAVD88)		577.90		577.90		577.90		577.90		577.90
SV Variance		-0.29		-0.29		-0.53		-0.85		-0.88
8S Variance		-1.52		-1.73		-1.63		-1.77		-1.79

Well ID	September 28, 2016		October 1, 2016		October 5, 2016		October 8, 2016		October 12, 2016		October 15, 2016	
	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)
MW001M	11.08	575.93	10.99	576.02	10.9	576.11	11.05	575.96	10.96	576.05	10.91	576.10
MW001S	10.33	576.80	10.23	576.90	10.17	576.96	10.32	576.81	10.18	576.95	10.13	577.00
MW002M-R	11.84	577.08	11.71	577.22	11.68	577.25	11.81	577.11	11.68	577.25	11.66	577.27
MW002S-R	11.91	576.81	11.78	576.94	11.74	576.98	11.86	576.86	11.75	576.97	11.71	577.01
MW031M	10.66	577.19	10.64	577.21	10.58	577.27	10.71	577.14	10.6	577.25	10.58	577.27
MW031S	8.68	578.59	10.13	577.13	9.84	577.42	10.02	577.24	10.25	577.01	10.11	577.15
MW113S	11.32	576.86	11.23	576.95	11.16	577.02	11.3	576.88	11.16	577.02	11.12	577.07
MW113M	10.18	577.96	10.13	578.01	10.1	578.04	10.28	577.86	10.19	577.95	10.16	577.98
MW115P	9.61	577.58	9.54	577.65	9.49	577.70	9.67	577.52	9.49	577.70	9.49	577.70
MW115S	10.04	576.77	9.94	576.87	9.88	576.93	10.08	576.73	9.93	576.88	9.88	576.93
MW116P	9.49	578.48	9.81	578.16	9.52	578.45	9.7	578.27	9.56	578.41	9.64	578.33
MW116S	11.12	576.83	11.02	576.93	10.92	577.03	11.1	576.85	10.96	576.99	10.94	577.01
MW116D	6.59	580.36	6.65	580.30	6.68	580.27	6.71	580.24	6.79	580.16	6.82	580.13
EW-3		-		-		-		-		-		-
EW-10	22.3	565.46	21.99	565.77	22.49	565.27	24.25	563.51	23.78	563.98	23.51	564.25
EW-11	28.18	565.01	28.51	565.32	28.11	564.82	23.75	563.06	28.28	563.53	28.15	559.15
EW-13	16.51	557.55	23.15	557.22	23.52	557.62	17.98	562.00	23.92	557.45	20.95	564.81
EW-14	21.23	570.22	21.13	563.55	21.09	563.18	18.3	568.75	21.09	562.78	21.14	565.57
MW034M	11.13	575.49	11.18	575.44	11.18	575.44	11.3	575.32	11.26	575.36	11.25	575.37
MW034S	11.04	575.36	11.11	575.31	11.12	575.31	11.2	575.19	11.21	575.23	11.21	575.28
MW036M	10.89	575.94	10.92	575.91	10.94	575.89	11.05	575.78	11.02	575.81	11.04	575.79
MW036S	8.89	576.07	8.83	576.13	8.85	576.11	8.95	576.01	8.93	576.03	8.94	576.02
MW038M	11.18	576.51	11.28	576.41	11.29	576.40	11.37	576.32	11.37	576.32	11.39	576.30
MW038S	11.25	576.45	11.29	576.41	11.31	576.39	11.42	576.28	11.39	576.31	11.40	576.30
MW120D	6.58	580.80	6.18	581.20	6.38	581.00	6.89	580.49	6.63	580.75	6.72	580.66
MW120M	10.74	576.36	10.78	576.32	10.78	576.32	10.93	576.17	10.92	576.18	10.96	576.14
MW120S	10.26	576.41	10.21	576.46	10.19	576.48	10.46	576.21	10.36	576.31	10.34	576.33
EW-2		-		-		-		-		-		-
EW-8	9.18	577.60	9.2	577.58	9.23	577.55	9.33	577.45	9.28	577.50	9.33	577.45
EW-9	16.93	568.76	16.48	569.21	16.2	569.49	17.5	568.19	16.75	568.94	16.52	569.17
MW004M		-		-		-		-		-		-
MW004S	6.62	581.96	6.73	581.85	6.66	581.92	6.79	581.79	6.81	581.77	6.67	581.91
MW032M	7	581.21	6.93	581.28	6.89	581.32	7.2	581.01	7.11	581.10	7.01	581.20
MW032S	5.53	582.83	5.76	582.60	5.72	582.64	5.69	582.67	6.09	582.27	5.81	582.55
MW033M	5.88	582.90	5.98	582.80	5.93	582.85	6	582.78	6.07	582.71	5.89	582.89
MW033S	5.35	581.82	5.47	581.70	5.4	581.77	5.45	581.72	5.56	581.61	5.38	581.79
MW039M		-		-		-		-		-		-
MW039S	5.73	582.00	5.84	581.89	5.79	581.94	5.91	581.82	5.96	581.77	5.79	581.94
MW035M		-		-		-		-		-		-
MW035S	5.88	580.12	6.02	579.98	5.99	580.01	6.3	579.70	6.45	579.55	6.14	579.86
MW037M		-		-		-		-		-		-
MW037S	5.57	580.12	5.79	579.90	5.75	579.94	5.94	579.75	6.2	579.49	5.88	579.81
SG4	8.42	580.25	7.91	580.76	8.2	580.47	8.8	579.87	8.44	580.23	8.62	580.05
Rough Target Elevation Calc SV*		577.08		577.02		577.10		576.95		577.03		577.08
Rough Target Elevation Calc 8S*		576.08		576.05		576.04		575.91		575.94		575.94
Target Elevation (NAVD88)		577.90		577.90		577.90		577.90		577.90		577.90
SV Variance		-0.82		-0.88		-0.80		-0.95		-0.87		-0.82
8S Variance		-1.82		-1.85		-1.86		-1.99		-1.96		-1.96

Well ID	October 19, 2016		October 22, 2016		October 24, 2016		November 7, 2016		December 1, 2016		January 12, 2017	
	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)
MW001M	11.09	575.92	10.96	576.05	11.12	575.89	8.8	578.21	7.9	579.11	7.82	579.19
MW001S	10.37	576.76	10.22	576.91	10.37	576.76	8.91	578.22	8	579.13	NM	-
MW002M-R	11.83	577.09	11.72	577.21	11.88	577.04	10.49	578.46	9.58	579.39	9.44	579.53
MW002S-R	11.89	576.83	11.8	576.92	11.96	576.75	10.53	578.19	9.62	579.10	9.47	579.25
MW031M	10.74	577.11	10.66	577.19	10.79	577.06	9.5	578.36	8.54	579.33	8.45	579.42
MW031S	10.06	577.20	10.28	576.98	10.3	576.96	9.07	578.19	7.76	579.51	7.84	579.43
MW113S	11.31	576.87	11.18	577.00	11.34	576.84	9.89	578.30	8.97	579.22	8.83	579.36
MW113M	10.24	577.90	10.21	577.93	10.33	577.81	8.59	579.56	8.05	580.10	8.11	580.04
MW115P	9.83	577.36	10.15	577.04	10.32	576.87	8.85	578.34	8.09	579.10	8.01	579.18
MW115S	10.09	576.72	9.91	576.90	10.13	576.68	8.6	578.22	7.67	579.15	7.55	579.27
MW116P	9.74	578.23	9.82	578.15	9.9	578.07	9.65	578.32	9.24	578.73	9.05	578.92
MW116S	11.12	576.83	10.96	576.99	11.19	576.76	9.72	578.24	8.78	579.18	8.64	579.32
MW116D	28.85	558.10	30.41	556.54	29.02	557.93	21.31	565.64	14.2	572.75	36.85	550.10
EW-3		-		-		-		-		-		-
EW-10	23.2	564.56	23.18	564.58	23.5	564.26		-		-		-
EW-11	28.48	564.11	28.58	564.13	29.03	563.81		-		-		-
EW-13	22.23	557.25	22.61	557.15	22.64	556.70		-		-		-
EW-14	21.26	564.48	20.72	564.10	21.06	564.07		-		-		-
MW034M	11.34	575.28	11.38	575.24	11.44	575.18	10.13	576.49	9.82	576.80	9.64	576.98
MW034S	11.31	575.15	11.36	575.11	11.38	575.05	10.18	576.36	9.82	576.67	9.71	576.85
MW036M	11.17	575.66	11.18	575.65	11.21	575.62	10.73	576.11	10.47	576.37	10.33	576.51
MW036S	9.09	575.87	9.09	575.87	9.18	575.78	8.61	576.35	8.33	576.63	8.18	576.78
MW038M	11.48	576.21	11.53	576.16	11.59	576.10	11.22	576.47	10.95	576.74	10.81	576.88
MW038S	11.56	576.14	11.55	576.15	11.64	576.06	11.26	576.44	11.01	576.69	10.85	576.85
MW120D	6.61	580.77	6.82	580.56	7.24	580.14	6.99	580.39	7.29	580.08	7.85	579.52
MW120M	11.05	576.04	11.21	575.88	11.31	575.78	10.72	576.38	10.37	576.74	10.28	576.83
MW120S	10.63	576.04	10.58	576.09	10.81	575.86	10.39	576.28	9.98	576.69	9.93	576.74
EW-2		-		-		-		-		-		-
EW-8	9.47	577.31	9.53	577.25	9.56	577.22		-		-		-
EW-9	16.36	569.33	16.28	569.41	16.16	569.53		-		-		-
MW004M		-		-		-		-		-		-
MW004S	6.69	581.89	6.71	581.87	6.82	581.76	6.8	581.78	6.62	581.96	7	581.58
MW032M	7.04	581.17	7.03	581.18	7.23	580.98	7.18	581.03	7.05	581.16	7.57	580.64
MW032S	5.68	582.68	5.94	582.42	6.09	582.27	6.35	582.01	5.87	582.49	6.97	581.38
MW033M	5.91	582.87	5.94	582.84	5.59	583.19	6.02	582.76	5.83	582.95	5.71	583.07
MW033S	5.39	581.78	5.43	581.74	5.53	581.64	5.54	581.63	5.32	581.85	6.1	581.07
MW039M		-		-		-		-		-		-
MW039S	5.8	581.93	5.82	581.91	5.93	581.80	5.93	581.80	5.73	582.00	6.13	581.60
MW035M		-		-		-		-		-		-
MW035S	5.82	580.18	6.04	579.96	6.25	579.75	6.22	579.78	5.36	580.64	5.88	580.12
MW037M		-		-		-		-		-		-
MW037S	5.52	580.17	5.76	579.93	5.92	579.77	5.94	579.75	4.93	580.77	5.49	580.20
SG4	8.43	580.24	8.53	580.14	9.11	579.56	8.8	579.87	9.2	579.47	NM	-
Rough Target Elevation Calc SV*		576.92		577.01		576.86		578.39		579.32		579.42
Rough Target Elevation Calc 8S*		575.80		575.77		575.68		576.36		576.67		576.80
Target Elevation (NAVD88)		577.90		577.90		577.90		577.90		577.90		577.90
SV Variance		-0.98		-0.89		-1.04		0.49		1.42		1.52
8S Variance		-2.10		-2.13		-2.22		-1.54		-1.23		-1.10

Well ID	February 1, 2017		March 2, 2017		April 24, 2017		May 10, 2017	
	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)
MW001M	7.45	579.56	NM	-	5.48	581.53	5.26	581.75
MW001S	NM	-	NM	-	5.59	581.54	5.35	581.78
MW002M-R	9.18	579.79	8.95	580.03	7.23	581.78	7	582.02
MW002S-R	9.22	579.50	8.97	579.75	7.2	581.52	7	581.72
MW031M	8.14	579.73	7.95	579.92	6.3	581.58	6.1	581.78
MW031S	7.3	579.97	6.31	580.96	5.78	581.49	5.54	581.73
MW113S	8.58	579.61	8.35	579.84	6.59	581.60	6.37	581.82
MW113M	7.83	580.32	7.64	580.51	6.27	581.88	6.11	582.04
MW115P	7.2	579.99	6.81	580.38	5.19	582.01	5.05	582.15
MW115S	7.29	579.53	7.05	579.77	5.25	581.57	5.06	581.76
MW116P	8.74	579.23	8.43	579.54	6.4	581.58	6.55	581.43
MW116S	8.39	579.57	8.15	579.81	6.39	581.58	6.18	581.79
MW116D	25.03	561.92	15.84	571.11	9.37	577.58	45.67	541.28
EW-3		-		-		-		-
EW-10		-		-		-		-
EW-11		-		-		-		-
EW-13		-		-		-		-
EW-14		-		-		-		-
MW034M	9.25	577.37	9.06	577.56	7.71	578.91	7.42	579.20
MW034S	9.3	577.24	9.1	577.43	7.73	578.78	7.47	579.07
MW036M	10.11	576.74	9.8	577.05	8.36	578.52	8.06	578.82
MW036S	NM	-	NM	-	6.11	578.85	5.79	579.18
MW038M	10.59	577.10	10.27	577.42	8.64	579.05	8.3	579.39
MW038S	10.65	577.05	10.3	577.41	8.61	579.10	8.27	579.44
MW120D	7.31	580.06	7.48	579.89	6.44	580.94	6.5	580.88
MW120M	9.79	577.32	9.62	577.50	8.26	578.88	8.1	579.04
MW120S	9.42	577.26	9.27	577.41	7.72	578.96	7.66	579.02
EW-2		-		-		-		-
EW-8		-		-		-		-
EW-9		-		-		-		-
MW004M		-		-		-		-
MW004S	6.63	581.95	6.39	582.19	5.26	583.32	5.28	583.30
MW032M	7.19	581.02	7.04	581.17	6.02	582.20	6.13	582.09
MW032S	6.41	581.95	6.15	582.21	5.25	583.11	5.48	582.88
MW033M	5.75	583.03	5.55	583.24	4.4	584.41	4.45	584.36
MW033S	5.3	581.87	5.14	582.03	4	583.17	4.03	583.14
MW039M		-		-		-		-
MW039S	5.75	581.98	5.48	582.25	4.39	583.34	4.4	583.33
MW035M		-		-		-		-
MW035S	4.7	581.30	4.47	581.53	4.31	581.69	4.51	581.49
MW037M		-		-		-		-
MW037S	4.13	581.57	3.91	581.79	3.85	581.85	4.05	581.65
SG4	NM	-	NM	-	8.25	580.42	8.18	580.49
Rough Target Elevation Calc SV*		579.73		580.07		581.61		581.82
Rough Target Elevation Calc 8S*		577.15		577.40		578.88		579.15
Target Elevation (NAVD88)		577.90		577.90		577.90		577.90
SV Variance		1.83		2.17		3.71		3.92
8S Variance		-0.75		-0.50		0.98		1.25

Tabke 14. 2016-2018 Pump Down Program Groundwater Elevation Monitoring

Tyco Fire Products LP, Marinette, Wisconsin

Target Elevation	577.9

Well ID	June 6, 2017		June 15, 2017		June 16, 2017		July 6, 2017		August 1, 2017		August 4, 2017		August 15, 2017	
	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)
MW001M	4.79	582.38	4.28	582.90	4.23	582.95	3.88	583.30	3.54	583.64	3.40	583.78	3.70	583.48
MW001S	4.86	582.40	4.38	582.88	4.31	582.95	3.95	583.31	3.60	583.66	3.44	583.82	3.74	583.52
MW002M-R	8.07	582.70	7.56	583.22	7.53	583.25	7.16	583.63	6.81	583.99	6.66	584.14	6.97	583.83
MW002S-R	7.93	582.39	7.43	582.89	7.41	582.91	7.01	583.31	6.68	583.64	6.55	583.77	6.84	583.48
MW031M	5.59	582.46	5.14	582.91	5.10	582.95	4.74	583.31	4.40	583.65	4.21	583.84	4.46	583.59
MW031S	6.27	582.63	5.77	583.13	5.80	583.10	5.58	583.32	5.26	583.64	4.95	583.95	5.20	583.70
MW113S	7.89	582.40	7.37	582.92	7.35	582.94	6.96	583.33	6.63	583.66	6.47	583.82	6.81	583.48
MW113M	7.68	582.62	7.29	583.01	7.30	583.00	7.08	583.22	6.97	583.33	6.75	583.55	7.00	583.30
MW113P	6.39	582.71	5.95	583.15	5.94	583.16	5.71	583.39	5.44	583.66	5.29	583.81	5.53	583.57
MW115S	6.60	582.40	6.08	582.92	6.05	582.95	5.68	583.32	5.34	583.66	5.19	583.81	5.49	583.51
MW116P	7.64	582.28	7.23	582.70	7.20	582.73	6.73	583.20	6.37	583.56	6.29	583.64	6.39	583.54
MW116S	7.48	582.44	6.97	582.95	6.93	583.00	6.56	583.37	6.22	583.71	6.03	583.90	6.35	583.58
MW119D	27.83	560.91	23.79	564.95	23.45	565.29	17.44	571.30	12.88	575.86	12.52	576.22	11.35	577.39
EW-3		-		-		-		-		-		-		-
EW-10		-		-		-		-	3.43	584.37	3.30	584.50	3.63	584.17
EW-11		-		-		-		-	3.00	584.34	2.93	584.41	3.20	584.14
EW-13		-		-		-		-	1.43	584.39	1.26	584.56	1.60	584.22
EW-14		-		-		-		-	2.47	584.32	2.30	584.49	2.58	584.21
MW034M	8.52	579.73	10.01	578.24	10.40	577.85	7.90	580.35	7.54	580.71	7.41	580.84	7.40	580.85
MW034S	8.65	579.57	8.25	579.97	8.34	579.88	8.00	580.22	7.61	580.62	7.52	580.71	7.47	580.76
MW036M	9.31	579.34	9.09	579.56	9.05	579.60	8.69	579.97	8.36	580.30	8.23	580.43	8.23	580.43
MW036S	8.59	579.69	8.35	579.93	8.32	579.96	7.95	580.33	7.56	580.72	7.50	580.78	7.44	580.84
MW038M	7.97	579.72	7.74	579.95	7.70	579.99	7.29	580.40	6.95	580.74	6.85	580.84	6.84	580.85
MW038S	7.94	579.77	7.68	580.03	7.63	580.08	7.22	580.49	6.91	580.80	6.86	580.85	6.80	580.91
MW120D	7.92	580.91	7.32	581.52	7.40	581.44	7.27	581.57	7.30	581.54	6.74	582.10	7.17	581.67
MW120M	9.38	579.62	9.00	580.01	9.00	580.01	8.75	580.26	8.36	580.66	8.20	580.82	8.22	580.80
MW120S	8.96	579.64	8.52	580.08	8.55	580.05	8.32	580.28	7.94	580.66	7.69	580.91	7.78	580.82
EW-2		-		-		-		-		-		-		-
EW-8		-		-		-		-	4.90	581.89	4.84	581.95	4.30	582.49
EW-9		-		-		-		-	4.37	581.34	4.24	581.47	4.77	580.94
MW004M		-		-		-		-		-		-		-
MW004S	5.08	583.50	4.76	583.82	4.70	583.88	4.81	583.77	5.12	583.46	5.03	583.55	5.10	583.48
MW032M	5.84	582.38	5.42	582.80	5.50	582.72	5.67	582.55	5.75	582.47	5.53	582.69	5.77	582.45
MW032S	5.10	583.26	4.64	583.72	4.66	583.70	5.10	583.26	5.33	583.03	5.12	583.24	5.30	583.06
MW033M	4.23	584.58	3.89	584.92	3.85	584.97	4.01	584.80	4.32	584.49	4.21	584.60	4.28	584.53
MW033S	3.80	583.37	3.42	583.75	3.41	583.76	3.59	583.58	3.89	583.28	3.78	583.39	3.89	583.28
MW039M		-		-		-		-		-		-		-
MW039S	4.21	583.52	3.85	583.89	3.80	583.94	3.94	583.80	4.25	583.48	4.14	583.59	4.21	583.52
MW035M		-		-		-		-		-		-		-
MW035S	5.83	581.84	5.60	582.07	5.66	582.01	6.06	581.61	6.56	581.11	6.04	581.63	6.18	581.49
MW037M		-		-		-		-		-		-		-
MW037S	5.07	582.01	4.91	582.17	4.94	582.14	5.43	581.65	6.14	580.94	5.53	581.55	5.65	581.43
SG4	7.68	581.21	7.7	581.19	7.90	580.99	7.50	581.39	7.70	581.19	7.00	581.89	7.70	581.19
Rough Target Elevation Calc SV*		582.48		582.97		583.00		583.34		583.66		583.84		583.55
Rough Target Elevation Calc 8S*		579.63		579.72		579.68		580.29		580.65		580.77		580.78
Target Elevation (NAVD88)		577.90		577.90		577.90		577.90		577.90		577.90		577.90
SV Variance		4.58		5.07		5.10		5.44		5.76		5.94		5.65
8S Variance		1.73		1.82		1.78		2.39		2.75		2.87		2.88

Well ID	August 23, 2017		August 25, 2017		August 29, 2017		September 1, 2017		September 6, 2017		September 11, 2017		September 14, 2017	
	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)
MW001M	3.81	583.37	4.01	583.17	3.73	583.45	8.61	578.56	6.32	580.85	4.46	582.71	4.25	582.93
MW001S	3.87	583.39	4.07	583.19	3.80	583.46	7.61	579.65	5.50	581.76	4.50	582.76	4.34	582.92
MW002M-R	7.08	583.71	7.28	583.51	7.00	583.79	10.58	580.15	8.31	582.46	7.70	583.08	7.50	583.29
MW002S-R	6.95	583.37	7.16	583.16	6.88	583.44	10.46	579.86	8.26	582.06	7.59	582.73	7.37	582.95
MW031M	4.59	583.46	4.79	583.26	4.52	583.53	7.33	580.70	5.29	582.76	5.36	582.69	4.97	583.08
MW031S	5.31	583.59	5.55	583.35	5.29	583.61	8.11	580.79	6.15	582.75	6.19	582.71	5.90	583.00
MW113S	6.90	583.39	7.12	583.17	6.82	583.47	10.78	579.51	8.65	581.64	7.51	582.78	7.32	582.97
MW113M	7.18	583.12	7.28	583.02	7.11	583.19	9.65	580.65	7.80	582.50	7.64	582.66	7.49	582.81
MW113P	5.62	583.48	5.78	583.32	5.58	583.52	8.20	580.89	6.29	582.81	6.16	582.94	5.97	583.13
MW115S	5.60	583.40	5.81	583.19	5.56	583.44	9.21	579.79	7.18	581.82	6.27	582.73	6.00	583.00
MW116P	6.43	583.50	6.55	583.38	6.42	583.51	7.14	582.79	6.99	582.94	7.13	582.80	6.96	582.97
MW116S	6.48	583.45	6.67	583.26	6.38	583.55	10.26	579.65	8.50	581.42	7.14	582.78	6.90	583.03
MW119D	10.69	578.05	10.56	578.18	10.28	578.46	10.07	578.67	9.87	578.87	9.59	579.15	9.45	579.29
EW-3		-		-		-		-		-		-		-
EW-10	3.87	583.93	3.86	583.94	3.61	584.19	21.35	566.41	17.31	570.46	4.40	583.40	4.28	583.52
EW-11	3.30	584.04	3.41	583.93	3.20	584.14	22.55	564.76	18.22	569.10	4.00	583.34	3.72	583.62
EW-13	1.72	584.10	1.87	583.95	1.60	584.22	17.12	568.65	17.27	568.50	2.37	583.45	2.19	583.63
EW-14	2.65	584.14	2.74	584.05	2.58	584.21	18.94	567.78	16.32	570.41	3.33	583.46	3.11	583.68
MW034M	7.37	580.88	7.44	580.81	7.30	580.95	9.44	578.81	8.36	579.89	7.70	580.55	7.60	580.65
MW034S	7.46	580.77	7.55	580.68	7.34	580.89	9.68	578.54	8.70	579.52	7.79	580.43	7.68	580.54
MW036M	8.18	580.49	8.21	580.46	8.02	580.65	9.16	579.49	8.50	580.16	8.59	580.07	8.39	580.27
MW036S	7.39	580.89	7.46	580.82	7.31	580.97	8.32	579.96	7.78	580.50	7.79	580.49	7.66	580.62
MW038M	6.78	580.91	6.89	580.80	6.77	580.92	7.93	579.76	7.21	580.48	7.27	580.42	7.14	580.55
MW038S	6.78	580.93	6.85	580.86	6.72	580.99	8.04	579.67	7.40	580.31	7.20	580.51	7.13	580.58
MW120D	7.50	581.34	7.16	581.68	7.20	581.64	7.35	581.49	7.30	581.54	7.54	581.30	7.49	581.35
MW120M	7.22	581.82	8.28	580.74	8.07	580.95	9.03	579.97	8.49	580.52	8.48	580.53	8.38	580.64
MW120S	7.85	580.75	7.96	580.64	7.67	580.93	8.14	580.46	7.97	580.63	8.05	580.55	7.96	580.64
EW-2		-		-		-		-		-		-		-
EW-8	4.65	582.14	4.75	582.04	4.56	582.23	9.04	577.74	7.92	578.86	5.21	581.58	4.97	581.82
EW-9	4.28	581.43	4.34	581.37	4.12	581.59	12.40	573.29	11.85	573.85	4.53	581.18	4.48	581.23
MW004M		-		-		-		-		-		-		-
MW004S	5.36	583.22	5.50	583.08	5.44	583.14	5.57	583.01	5.48	583.10	5.60	582.98	5.70	582.88
MW032M	6.02	582.20	6.07	582.15	5.85	582.37	5.94	582.28	5.97	582.25	6.04	582.18	6.13	582.09
MW032S	5.55	582.81	5.74	582.62	5.48	582.88	5.49	582.87	5.42	582.94	5.62	582.74	5.73	582.63
MW033M	4.56	584.24	4.68	584.12	4.59	584.21	4.66	584.14	4.60	584.20	4.74	584.06	4.85	583.95
MW033S	4.13	583.04	4.24	582.93	4.16	583.01	4.28	582.89	4.13	583.04	4.34	582.83	4.42	582.75
MW039M		-		-		-		-		-		-		-
MW039S	4.49	583.24	4.61	583.12	4.53	583.20	4.59	583.14	4.55	583.18	4.70	583.03	4.79	582.94
MW035M		-		-		-		-		-		-		-
MW035S	7.02	580.65	7.19	580.48	6.87	580.80	6.31	581.36	6.62	581.05	6.95	580.72	7.18	580.49
MW037M		-		-		-		-		-		-		-
MW037S	6.59	580.48	6.79	580.28	6.40	580.68	5.84	581.24	6.12	580.96	6.54	580.54	6.83	580.24
SG4	7.90	580.99	7.47	581.42	7.48	581.41	7.80	581.09	7.65	581.24	7.90	580.99	7.82	581.07
Rough Target Elevation Calc SV*		583.43		583.23		583.49		579.93		582.00		582.77		583.00
Rough Target Elevation Calc 8S*		580.93		580.72		580.91		579.58		580.25		580.44		580.56
Target Elevation (NAVD88)		577.90		577.90		577.90		577.90		577.90		577.90		577.90
SV Variance		5.53		5.33		5.59		2.03		4.10		4.87		5.10
8S Variance		3.03		2.82		3.01		1.68		2.35		2.54		2.66

Well ID	September 25, 2017		September 29, 2017		October 2, 2017		October 4, 2017		October 9, 2017		October 11, 2017		October 16, 2017	
	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)
MW001M	7.89	579.28	8.82	578.35		-	8.99	578.18	8.1	579.07	6.01	581.16	5.57	581.60
MW001S	6.75	580.51	7.76	579.50		-	7.93	579.33	6.97	580.29	6.11	581.15	5.63	581.63
MW002M-R	9.66	581.08	10.70	580.02	10.57	580.16	10.92	579.80	9.94	580.80	9.27	581.48	8.81	581.95
MW002S-R	9.62	580.70	10.62	579.70	10.26	580.06	10.85	579.47	9.82	580.50	8.8	581.52	8.7	581.62
MW031M	6.11	581.93	7.84	580.19	7.05	580.99	7.73	580.30	6.53	581.51	6.88	581.16	6.28	581.76
MW031S	7.72	581.18	8.62	580.28	8.62	580.28	9.5	579.40	7.64	581.26	7.75	581.15	7.22	581.68
MW113S	9.90	580.39	10.52	579.77	10.5	579.79	10.91	579.38	10.03	580.26	9.12	581.17	8.67	581.62
MW113M	8.90	581.40	9.41	580.89	9.89	580.41	10.11	580.19	9.15	581.15	8.62	581.68	8.28	582.02
MW113P	7.02	582.08	7.98	581.11	7.7	581.39	7.96	581.13	8.5	580.59	8.68	580.41	7.55	581.55
MW115S	8.46	580.54	9.43	579.57	9.31	579.69	9.4	579.60	8.27	580.73	7.84	581.16	7.45	581.55
MW116P	7.58	582.35	8.13	581.79	8.1	581.82	8.63	581.29	8.25	581.67	8.64	581.28	8.34	581.58
MW116S	9.63	580.28	10.48	579.43	10.33	579.58	10.64	579.27	9.74	580.17	8.72	581.20	8.25	581.67
MW119D	9.06	579.68	8.96	579.78	8.89	579.85	8.54	580.20	8.72	580.02	8.7	580.04	8.65	580.09
EW-3		-		-		-		-		-		-		-
EW-10	18.55	569.21	19.40	568.36	16.2	571.57	20.91	566.85	18.45	569.32	5.97	581.82	5.48	582.31
EW-11	22.88	564.43	22.40	564.91	27.52	559.78	28.27	559.03	27.14	560.16	5.45	581.89	4.9	582.44
EW-13	22.02	563.73	22.70	563.05		-	7.72	578.08	6.03	579.78	4.08	581.73	3.47	582.35
EW-14	18.00	568.72	18.60	568.12	17.45	569.27	16.5	570.23	17.24	569.49	4.88	581.90	4.45	582.33
MW034M	7.84	580.41	9.18	579.07	9.55	578.70	9.79	578.46	9.47	578.78	8.31	579.94	8.22	580.03
MW034S	7.88	580.34	9.47	578.75	9.76	578.46	9.96	578.26	9.6	578.62	8.41	579.81	8.31	579.91
MW036M	8.69	579.97	9.11	579.54	9.37	579.27	9.61	579.03	9.35	579.29	9.11	579.54	9.05	579.60
MW036S	7.94	580.34	8.42	579.86	8.56	579.72	8.8	579.48	8.59	579.69	8.44	579.84	8.34	579.94
MW038M	7.44	580.25	7.85	579.84		-	8.45	579.24	8.14	579.55	7.94	579.75	7.84	579.85
MW038S	7.39	580.32	8.09	579.62		-	8.57	579.14	8.3	579.41	7.93	579.78	7.8	579.91
MW120D	7.45	581.39	7.80	581.03	7.5	581.34	7.77	581.06	7.37	581.47	7.35	581.49	7.52	581.32
MW120M	8.60	580.41	9.11	579.89	9.19	579.81	9.43	579.57	9.23	579.77	9.03	579.97	9.01	580.00
MW120S	8.19	580.41	8.58	580.02	8.4	580.20	8.61	579.99	8.61	579.99	8.71	579.89	8.67	579.93
EW-2		-		-		-		-		-		-		-
EW-8	5.33	581.46	8.70	578.08	9.6	577.18	9.38	577.40	8.95	577.83	5.83	580.96	5.65	581.14
EW-9	4.76	580.95	14.25	571.44	15.19	570.50	16.25	569.44	16.54	569.15	5.22	580.49	5.12	580.59
MW004M		-		-		-		-		-		-		-
MW004S	5.94	582.64	6.02	582.56		-	6.15	582.43	5.95	582.63	5.94	582.64	5.8	582.78
MW032M		-	4.83	581.73		-	5.02	581.54	4.71	581.86	4.6	581.97	4.5	582.07
MW032S		-	4.45	582.24		-	4.58	582.11	4.27	582.42	4.26	582.43	4.09	582.60
MW033M	4.99	583.81	5.18	583.61		-	5.28	583.51	5.01	583.78	5.15	583.64	4.96	583.84
MW033S	4.65	582.52	4.74	582.43		-	4.88	582.29	4.55	582.62	4.7	582.47	4.54	582.63
MW039M		-		-		-		-		-		-		-
MW039S	5.00	582.73	5.14	582.60		-	5.19	582.55	5.02	582.72	5.06	582.68	4.9	582.84
MW035M		-		-		-		-		-		-		-
MW035S	7.22	580.45	7.55	580.12	7.72	579.95	7.8	579.87	6.45	581.22	6.74	580.93	6.13	581.54
MW037M	7.64	579.21		-		-		-		-		-		-
MW037S	6.85	580.22	7.06	580.01	7.25	579.82	7.34	579.73	5.83	581.25	6.23	580.85	5.49	581.59
SG4		-	8.16	580.73	6.85	582.04	8.11	580.78	7.76	581.13	8	580.89	7.85	581.04
Rough Target Elevation Calc SV*		580.73		579.77		580.12		579.49		580.57		581.28		581.71
Rough Target Elevation Calc 8S*		580.31		579.57		579.36		579.15		579.39		579.82		579.90
Target Elevation (NAVD88)		577.90		577.90		577.90		577.90		577.90		577.90		577.90
SV Variance		2.83		1.87		2.22		1.59		2.67		3.38		3.81
8S Variance		2.41		1.67		1.46		1.25		1.49		1.92		2.00

Well ID	October 26, 2017		November 21, 2017		December 4, 2017		January 13, 2018		February 21, 2018		March 8, 2018		March 30, 2018	
	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)
MW001M	5.47	581.70	5.31	581.86	5.04	582.13	6.39	580.78		-		-	5.21	581.96
MW001S	5.59	581.67	5.4	581.86	5.13	582.13		-		-		-	5.25	582.01
MW002M-R	8.71	582.05	8.56	582.21	8.32	582.45	9.64	581.10	10.32	580.41	9.16	581.59	8.44	582.33
MW002S-R	8.58	581.74	8.48	581.84	8.23	582.09	9.55	580.77	10.23	580.09	9.04	581.28	8.33	581.99
MW031M	6.18	581.86	5.88	582.16	5.95	582.09	7.01	581.03	7.66	580.37	6.69	581.35	6.00	582.04
MW031S	7.13	581.77	6.77	582.13	6.9	582.00	7.96	580.94	8.67	580.23	7.6	581.30	6.81	582.09
MW113S	8.56	581.73	8.43	581.86	8.18	582.11	9.46	580.83	10.14	580.15	9.01	581.28	8.28	582.01
MW113M	8.31	581.99	8.13	582.17	8.13	582.17	9.02	581.28	9.89	580.41	8.68	581.62	8.23	582.07
MW113P	7.26	581.84	7.29	581.81	7.05	582.05	8.65	580.44	9.3	579.79	7.31	581.79	6.03	583.07
MW115S	7.24	581.76	7.07	581.93	6.88	582.12	8.2	580.80	8.9	580.10	7.71	581.29	7.01	581.99
MW116P	8.05	581.87	8.18	581.74	8.04	581.88	9.32	580.60	9.81	580.10	8.75	581.17	7.84	582.08
MW116S	8.11	581.81	7.99	581.93	7.74	582.18	9.08	580.84	9.76	580.15	8.59	581.33	7.87	582.05
MW119D	8.5	580.24	8.18	580.56	8.19	580.55	8.32	580.42	8.33	580.41	8.3	580.44	8.25	580.49
EW-3		-		-		-		-		-		-		-
EW-10	5.36	582.43		-		-		-		-		-		-
EW-11	4.87	582.47		-		-		-		-		-		-
EW-13	3.45	582.37		-		-		-		-		-		-
EW-14	4.31	582.48		-		-		-		-		-		-
MW034M	8.08	580.17	8.14	580.11	7.94	580.31	8.82	579.43	9.24	579.01	8.52	579.73	7.69	580.56
MW034S	8.15	580.07	8.22	580.00	7.95	580.27	8.92	579.30	9.41	578.81	8.66	579.56	7.73	580.49
MW036M	8.91	579.74	8.9	579.75	8.76	579.90	9.72	578.92	10.04	578.59	9.48	579.16	8.60	580.06
MW036S	8.19	580.09	8.22	580.06	8.04	580.24	8.97	579.30	9.39	578.88	8.75	579.53	7.86	580.42
MW038M	7.72	579.97	7.74	579.95	7.56	580.13	8.55	579.14	8.94	578.75	8.33	579.36	7.39	580.30
MW038S	7.68	580.03	7.71	580.00	7.53	580.18	8.52	579.19	8.92	578.79	8.3	579.41	7.34	580.37
MW120D	7.8	581.03	8.13	580.70	7.51	581.33	8.18	580.65	7.89	580.94	7.99	580.84	8.30	580.53
MW120M	8.84	580.17	8.93	580.08	8.59	580.42	9.68	579.31	10.14	578.85	9.24	579.76	8.48	580.53
MW120S	8.47	580.13	8.58	580.02	8.14	580.46	9.43	579.17	10.03	578.57	8.89	579.71	7.97	580.63
EW-2		-		-		-		-		-		-		-
EW-8	5.53	581.26		-		-		-		-		-		-
EW-9	4.9	580.81		-		-		-		-		-		-
MW004M		-		-		-		-		-		-		-
MW004S	5.83	582.75	5.88	582.70	5.98	582.60	6.82	581.76	7.04	581.54	6.29	582.29	5.96	582.62
MW032M	4.65	581.92	6.26	580.30	6.32	581.91	7.03	581.19	7.18	581.04	6.54	581.68	6.46	581.76
MW032S	4.18	582.51	5.85	580.84	5.83	582.53	6.73	581.63	6.45	581.91	5.91	582.45	5.80	582.56
MW033M	5	583.79	4.98	583.82	5.04	583.75	5.98	582.80	6.1	582.68		-	5.00	583.79
MW033S	4.55	582.62	4.5	582.67	4.7	582.47	5.5	581.67	5.73	581.44		-	4.68	582.49
MW039M		-		-		-		-		-		-		-
MW039S	4.93	582.81	4.98	582.76	5.1	582.64	5.95	581.78	6.16	581.57	5.41	582.33	5.07	582.67
MW035M		-		-		-		-		-		-		-
MW035S	6.72	580.95	6.24	581.43	5.91	581.76	7.02	580.65	7.39	580.28	5.63	582.04	5.72	581.95
MW037M		-		-		-		-		-		-		-
MW037S	6.12	580.96	5.49	581.59	5.34	581.74	6.4	580.68	6.8	580.27	4.93	582.15	5.01	582.07
SG4	8.13	580.76	8.5	580.39	7.8	581.09		-		-		-		-
Rough Target Elevation Calc SV*		581.81		582.00		582.15		580.93		580.24		581.38		582.06
Rough Target Elevation Calc 8S*		580.05		580.00		580.24		579.22		578.78		579.53		580.42
Target Elevation (NAVD88)		577.90		577.90		577.90		577.90		577.90		577.90		577.90
SV Variance		3.91		4.10		4.25		3.03		2.34		3.48		4.16
8S Variance		2.15		2.10		2.34		1.32		0.88		1.63		2.52

Well ID	April 4, 2018		April 10, 2018		April 11, 2018		April 12, 2018		April 19, 2018		April 23, 2018		April 26, 2018	
	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)
MW001M	4.82	582.35	4.63	582.54	4.41	582.76	4.27	582.91	4.33	582.85	6.03	581.14	9.20	577.97
MW001S		-	4.66	582.60	4.45	582.81	4.31	582.95		-	7.21	580.05	8.19	579.07
MW002M-R	8.05	582.72	7.87	582.91	7.64	583.14	7.56	583.22	7.62	583.16	9.87	580.87	11.13	579.59
MW002S-R	7.95	582.37	7.72	582.60	7.52	582.80	7.41	582.91	7.45	582.87	9.75	580.57	11.04	579.28
MW031M	5.54	582.51	5.44	582.61	5.26	582.79	5.06	582.99	5.08	582.97	6.09	581.95	8.51	579.52
MW031S	6.30	582.60	6.24	582.66	6.04	582.86	5.81	583.09	5.88	583.02	7.65	581.25	8.91	579.99
MW113S	7.89	582.40	7.69	582.60	7.48	582.81	7.39	582.90	7.44	582.85	10.03	580.26	11.24	579.05
MW113M	7.91	582.39	7.83	582.47	7.71	582.59	7.59	582.71	7.51	582.79	8.58	581.72	9.62	580.68
MW113P	5.73	583.37	5.69	583.41	5.66	583.44	5.42	583.68	5.47	583.63	5.94	583.16	6.35	582.75
MW115S	6.60	582.40	6.39	582.61	6.18	582.82	6.03	582.97	6.12	582.88	8.35	580.65	9.60	579.40
MW116P	7.25	582.68	7.02	582.91	6.95	582.98	6.77	583.16	6.76	583.17	7.00	582.93	7.79	582.13
MW116S	7.47	582.45	7.24	582.68	7.04	582.88	6.92	583.01	7.02	582.90	10.42	579.49	11.46	578.44
MW119D	8.25	580.49	8.29	580.45	8.27	580.47	8.28	580.46	8.16	580.58	8.18	580.56	8.24	580.50
EW-3		-		-		-		-		-		-		-
EW-10		-		-		-	4.17	583.63		-	15.02	572.75	20.59	567.17
EW-11		-		-		-	4.17	583.17		-	17.53	569.79	21.84	565.47
EW-13		-		-		-	2.10	583.72	2.21	583.61	7.22	578.58	8.01	577.79
EW-14		-		-		-	3.04	583.75	3.06	583.73	11.69	575.06	16.38	570.35
MW034M	7.45	580.80	7.19	581.06	7.09	581.16	7.01	581.24	6.88	581.37	8.45	579.80	8.88	579.37
MW034S	7.49	580.74	7.20	581.03	7.11	581.12	7.05	581.18	6.91	581.32	8.61	579.61	9.05	579.17
MW036M	8.41	580.25	8.13	580.54	8.07	580.60	8.00	580.67	7.79	580.88	8.17	580.50	8.96	579.69
MW036S	7.65	580.63	7.35	580.93	7.28	581.00	7.20	581.08	7.00	581.28	7.31	580.97	8.10	580.18
MW038M	7.11	580.58	6.83	580.86	6.75	580.94	6.65	581.04	6.41	581.28	6.92	580.77	7.90	579.79
MW038S	7.06	580.65	6.77	580.94	6.68	581.03	6.59	581.12	6.32	581.39	6.95	580.76	7.96	579.75
MW120D	7.80	581.03	8.13	580.70	8.15	580.68	7.95	580.88	7.68	581.15	7.65	581.18	7.59	581.24
MW120M	8.23	580.79	7.89	581.13	7.80	581.23	7.71	581.32	7.63	581.40	7.89	581.13	8.32	580.70
MW120S	7.68	580.92	7.31	581.29	7.13	581.47	7.09	581.51	7.10	581.50	6.83	581.78	7.10	581.50
EW-2		-		-		-		-		-		-		-
EW-8		-		-		-	4.64	582.15		-	7.91	578.87	9.34	577.44
EW-9		-		-		-	3.96	581.75	3.72	581.99	12.19	573.50	12.12	573.57
MW004M		-		-		-		-		-		-		-
MW004S	5.83	582.75	5.69	582.89	5.63	582.95	5.45	583.13	5.26	583.32	4.85	583.73	4.59	583.99
MW032M	6.30	581.93	6.26	581.97	6.17	582.06	5.93	582.30	5.80	582.43	5.50	582.73	5.45	582.78
MW032S	5.69	582.67	10.85	577.50	10.35	578.00	9.71	578.64	7.28	581.08	6.56	581.80	6.23	582.13
MW033M	4.90	583.90	4.75	584.05	4.68	584.12	4.76	584.04	4.31	584.50	3.81	585.01	3.59	585.23
MW033S	4.54	582.63	4.41	582.76	4.32	582.85	4.18	582.99	3.94	583.23	3.44	583.73	3.18	583.99
MW039M		-		-		-		-		-		-		-
MW039S	4.94	582.80	4.80	582.94	4.75	582.99	4.54	583.20	2.72	583.37	2.26	583.83	2.03	584.06
MW035M		-		-		-		-		-		-		-
MW035S	5.63	582.04	5.71	581.96	5.68	581.99	5.48	582.19	5.54	582.13	5.57	582.10	5.62	582.05
MW037M		-		-		-		-		-		-		-
MW037S	4.93	582.15	4.96	582.12	4.94	582.14	4.71	582.37	4.74	582.34	5.79	581.29	4.88	582.20
SG4		-		-		-		-	8.06	580.83	7.95	580.94	7.95	580.94
Rough Target Elevation Calc SV*		582.47		582.63		582.83		582.97		582.92		580.80		579.30
Rough Target Elevation Calc 8S*		580.67		580.97		581.07		581.14		581.30		580.66		580.02
Target Elevation (NAVD88)		577.90		577.90		577.90		577.90		577.90		577.90		577.90
SV Variance		4.57		4.73		4.93		5.07		5.02		2.90		1.40
8S Variance		2.77		3.07		3.17		3.24		3.40		2.76		2.12

Well ID	May 1, 2018		May 4, 2018		May 8, 2018		May 10, 2018		May 15, 2018		May 18, 2018		May 22, 2018	
	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)
MW001M	10.27	576.90	10.38	576.79	10.22	576.95	10.29	576.88	10.20	576.97	10.45	576.72	10.00	577.17
MW001S	9.35	577.91	9.51	577.75	9.28	577.98	9.41	577.85	9.28	577.98	9.58	577.68	9.09	578.17
MW002M-R	12.24	578.46	12.40	578.29	12.19	578.51	12.29	578.40	12.18	578.52	12.49	578.20	12.00	578.70
MW002S-R	12.16	578.16	12.34	577.98	12.16	578.16	12.24	578.08	12.05	578.27	12.41	577.91	11.92	578.40
MW031M	9.01	579.01	9.78	578.24	9.25	578.77	9.55	578.47	9.11	578.91	9.85	578.17	9.06	578.96
MW031S	10.08	578.82	10.82	578.08	10.55	578.35	10.81	578.09	10.53	578.37	11.00	577.90	10.41	578.49
MW113S	12.23	578.05	12.40	577.88	12.13	578.15	12.22	578.06	12.10	578.18	12.49	577.79	11.92	578.37
MW113M	10.86	579.43	10.87	579.42	10.78	579.52	10.85	579.44	10.74	579.56	11.13	579.16	10.81	579.49
MW113P	7.01	582.09	6.84	582.26	6.97	582.13	7.18	581.92	8.66	580.43	9.06	580.03	8.69	580.40
MW115S	10.72	578.28	10.90	578.09	10.60	578.40	10.73	578.27	10.70	578.30	11.14	577.85	10.53	578.47
MW116P	8.14	581.78	8.20	581.72	8.71	581.21	9.82	580.09	9.04	580.88	9.34	580.58	9.22	580.70
MW116S	12.02	577.88	11.92	577.98	11.88	578.02	11.76	578.14	11.70	578.20	12.04	577.86	11.55	578.35
MW119D	8.16	580.58	58.34	530.40	55.11	533.63	53.24	535.50	48.45	540.29	45.69	543.05	42.24	546.50
EW-3		-		-		-		-		-		-		-
EW-10	22.79	564.97	22.76	565.00	23.38	564.37	23.20	564.55	19.87	567.89	23.80	563.95	21.30	566.46
EW-11	19.14	568.18	23.62	563.69	22.92	564.39	25.85	561.45	24.63	562.68	29.74	557.56	27.98	559.32
EW-13	8.45	577.35	9.08	576.72	7.68	578.12	8.06	577.74	10.15	575.64	10.17	575.62	8.53	577.27
EW-14	15.74	570.99	16.03	570.70	17.00	569.73	16.57	570.16	20.18	566.53	20.38	566.33	20.33	566.38
MW034M	8.91	579.34	9.08	579.17	9.17	579.08	9.33	578.92	9.58	578.67	9.89	578.36	9.86	578.39
MW034S	9.08	579.14	9.24	578.98	9.32	578.90	9.45	578.77	9.70	578.52	10.00	578.22	9.98	578.24
MW036M	9.07	579.58	9.42	579.22	9.64	579.00	9.90	578.73	9.22	579.43	10.51	578.11	10.41	578.22
MW036S	8.18	580.10	8.60	579.68	8.77	579.51	9.02	579.25	9.25	579.02	9.71	578.56	9.58	578.69
MW038M	8.00	579.69	8.33	579.36	8.61	579.08	8.95	578.74	9.20	578.49	9.73	577.96	9.51	578.18
MW038S	8.06	579.65	8.41	579.30	8.66	579.05	9.02	578.69	9.28	578.43	9.82	577.89	9.59	578.12
MW120D	7.40	581.44	7.39	581.45	7.33	581.51	7.64	581.19	7.00	581.84	7.21	581.63	7.30	581.54
MW120M	8.42	580.60	8.60	580.41	8.65	580.36	8.82	580.19	9.14	579.86	9.51	579.49	9.48	579.52
MW120S	7.29	581.31	7.46	581.14	7.53	581.07	7.71	580.89	8.24	580.36	8.65	579.95	8.57	580.03
EW-2		-		-		-		-		-		-		-
EW-8	9.32	577.46	9.95	576.83	10.24	576.54	10.71	576.07	10.88	575.90	11.63	575.14	11.37	575.40
EW-9	11.91	573.79	12.27	573.42	12.05	573.65	12.06	573.64	12.31	573.38	11.26	574.44	12.41	573.28
MW004M		-		-		-		-		-		-		-
MW004S	4.52	584.06	4.19	584.39	4.44	584.14	4.32	584.26	4.58	584.00	4.62	583.96	4.92	583.66
MW032M	5.53	582.70	5.34	582.89	5.53	582.70	5.43	582.80	5.68	582.55	5.80	582.43	5.85	582.38
MW032S	14.87	573.47	14.24	574.10	13.55	574.79	13.32	575.02	12.60	575.75	12.26	576.09	11.83	576.52
MW033M	3.94	584.87	3.73	585.09	3.58	585.24	5.49	583.30	3.74	585.08	4.95	583.85	4.07	584.74
MW033S	3.19	583.98	2.95	584.22	3.13	584.04	3.31	583.86	3.29	583.88	3.52	583.65	3.65	583.52
MW039M		-		-		-		-		-		-		-
MW039S	1.97	584.12	1.58	584.51	1.88	584.21	1.75	584.34	2.00	584.09	2.25	583.84	2.38	583.71
MW035M		-		-		-		-		-		-		-
MW035S	5.64	582.03	5.40	582.27	5.68	581.99	5.68	581.99	5.74	581.93	5.80	581.87	5.89	581.78
MW037M		-		-		-		-		-		-		-
MW037S	4.94	582.14	4.62	582.46	4.96	582.12	4.93	582.15	4.97	582.11	5.13	581.95	5.21	581.87
SG4	7.78	581.11	7.66	581.23	7.60	581.29	8.00	580.89	7.25	581.64	7.69	581.20	7.70	581.19
Rough Target Elevation Calc SV*		578.29		578.05		578.28		578.17		578.33		577.92		578.46
Rough Target Elevation Calc 8S*		579.93		579.66		579.51		579.27		579.10		578.57		578.67
Target Elevation (NAVD88)		577.90		577.90		577.90		577.90		577.90		577.90		577.90
SV Variance		0.39		0.15		0.38		0.27		0.43		0.02		0.56
8S Variance		2.03		1.76		1.61		1.37		1.20		0.67		0.77

Tabke 14. 2016-2018 Pump Down Program Groundwater Elevation Monitoring

Tyco Fire Products LP, Marinette, Wisconsin

Target Elevation	577.9

Well ID	May 24, 2018		May 25, 2018		May 29, 2018		May 31, 2018		June 5, 2018		June 8, 2018		June 12, 2018	
	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)
MW001M	10.33	576.84	9.68	577.49	9.47	577.70	9.99	577.18	10.25	576.92	10.71	576.46	10.19	576.98
MW001S	9.45	577.81	8.63	578.63	8.49	578.77	9.01	578.25	9.63	577.63	9.90	577.36	9.35	577.91
MW002M-R	12.44	578.25	11.63	579.08	11.40	579.31	12.03	578.67	12.26	578.44	12.86	577.82	12.06	578.64
MW002S-R	12.35	577.97	11.51	578.81	11.28	579.04	11.89	578.43	12.22	578.10	12.75	577.57	11.94	578.38
MW031M	9.89	578.13	9.20	578.82	8.15	579.88	9.29	578.73	9.34	578.68	10.22	577.80	9.46	578.56
MW031S	10.98	577.92	9.90	579.00	9.74	579.16	10.39	578.51	10.74	578.16	11.31	577.59	10.14	578.76
MW113S	12.39	577.89	11.55	578.74	11.31	578.98	11.96	578.33	12.23	578.05	12.78	577.50	11.37	578.92
MW113M	11.13	579.16	10.04	580.26	10.33	579.97	10.81	579.49	10.99	579.30	11.34	578.95	9.82	580.48
MW115P	9.14	579.95	8.77	580.32	8.49	580.60	8.67	580.42	9.10	579.99	9.79	579.30	9.23	579.86
MW115S	11.11	577.88	10.37	578.63	10.05	578.95	10.56	578.44	11.22	577.77	11.69	577.30	11.09	577.90
MW116P	9.43	580.49	9.32	580.60	9.14	580.78	9.15	580.77	9.31	580.61	9.76	580.16	9.57	580.35
MW116S	11.99	577.91	11.28	578.62	11.05	578.86	11.50	578.40	11.90	578.00	12.38	577.52	11.80	578.10
MW119D	40.51	548.23	39.94	548.80	37.01	551.73	35.52	553.22	32.35	556.39	30.63	558.11	28.47	560.27
EW-3		-		-		-		-		-		-		-
EW-10	23.86	563.89	20.93	566.83	23.46	564.29	23.74	564.01	21.54	566.22	21.69	566.07	19.43	568.33
EW-11	23.03	564.28	22.89	564.42	26.01	561.29	22.79	564.52	22.78	564.53	23.02	564.29	28.52	558.78
EW-13	10.39	575.40	11.22	574.57	9.91	575.88	8.26	577.54	20.26	565.49	20.73	565.02	19.46	566.30
EW-14	20.83	565.88	21.25	565.46	20.94	565.77	21.21	565.50	21.32	565.39	21.13	565.58	21.11	565.60
MW034M	10.08	578.17	10.40	577.85	10.44	577.81	10.74	577.51	10.84	577.41	11.19	577.06	11.13	577.12
MW034S	10.25	577.97	10.56	577.66	10.60	577.62	10.97	577.25	11.05	577.17	11.43	576.79	11.31	576.91
MW036M	10.77	577.85	10.48	578.14	10.42	578.21	10.89	577.73	10.93	577.69	11.36	577.25	11.01	577.60
MW036S	9.91	578.36	9.69	578.58	9.62	578.65	10.09	578.18	10.13	578.14	10.61	577.66	10.06	578.21
MW038M	9.91	577.78	9.60	578.09	9.43	578.26	10.01	577.68	10.00	577.69	10.43	577.26	10.04	577.65
MW038S	10.05	577.66	9.69	578.02	9.48	578.23	10.12	577.59	10.05	577.66	10.56	577.15	10.10	577.61
MW120D	7.17	581.67	7.33	581.51	7.22	581.62	6.87	581.97	7.35	581.49	7.37	581.47	7.57	581.27
MW120M	9.73	579.26	9.70	579.29	9.78	579.21	10.02	578.97	10.16	578.83	10.58	578.40	10.03	578.96
MW120S	8.85	579.75	8.66	579.94	8.86	579.74	8.94	579.66	9.25	579.35	9.70	578.90	8.99	579.61
EW-2		-		-		-		-		-		-		-
EW-8	12.05	574.72	11.52	575.25	11.27	575.50	12.02	574.75	11.95	574.82	12.38	574.39	12.69	574.08
EW-9	12.44	573.25	18.36	567.32	18.19	567.49	18.83	566.85	19.84	565.84	20.26	565.42	18.27	567.41
MW004M		-		-		-		-		-		-		-
MW004S	5.02	583.56	4.99	583.59	5.09	583.49	5.09	583.49	5.13	583.45	5.31	583.27	5.40	583.18
MW032M	5.88	582.35	5.86	582.37	5.90	582.33	5.81	582.42	5.96	582.27	6.07	582.16	6.89	581.33
MW032S	11.58	576.77	11.53	576.82	11.15	577.20	10.93	577.42	10.50	577.85	10.19	578.16	12.27	576.08
MW033M	4.11	584.70	4.12	584.69	4.21	584.60	4.20	584.61	4.25	584.56	4.46	584.34	4.54	584.26
MW033S	3.74	583.43	3.74	583.43	3.83	583.34	3.80	583.37	3.84	583.33	4.06	583.11	4.18	582.99
MW039M		-		-		-		-		-		-		-
MW039S	2.42	583.67	2.46	583.63	2.52	583.57	2.50	583.59	2.56	583.53	2.75	583.34	2.62	583.47
MW035M		-		-		-		-		-		-		-
MW035S	5.92	581.75	5.95	581.72	6.12	581.55	6.04	581.63	6.13	581.54	6.40	581.27	6.60	581.07
MW037M		-		-		-		-		-		-		-
MW037S	5.28	581.80	5.31	581.77	5.50	581.58	5.50	581.58	5.52	581.56	5.88	581.20	5.80	581.28
SG4	7.30	581.59	7.55	581.34	7.40	581.49	7.20	581.69	7.25	581.64	7.54	581.35	7.13	581.76
Rough Target Elevation Calc SV*		577.98		578.81		579.06		578.44		578.11		577.59		578.46
Rough Target Elevation Calc 8S*		578.35		578.45		578.47		578.07		577.99		577.56		577.96
Target Elevation (NAVD88)		577.90		577.90		577.90		577.90		577.90		577.90		577.90
SV Variance		0.08		0.91		1.16		0.54		0.21		-0.31		0.56
8S Variance		0.45		0.55		0.57		0.17		0.09		-0.34		0.06

Well ID	June 14, 2018		June 19, 2018		June 22, 2018		June 26, 2018		June 28, 2018		July 3, 2018		July 5, 2018	
	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)
MW001M	10.62	576.55	10.10	577.07	10.43	576.74	10.30	576.87	10.25	576.92	10.27	576.90	9.71	577.46
MW001S	9.79	577.47	9.18	578.08	9.52	577.74	9.43	577.83	9.36	577.90	9.39	577.87	8.91	578.35
MW002M-R	12.76	577.93	12.08	578.62	12.51	578.18	12.45	578.24	12.44	578.25	12.41	578.28	11.92	578.78
MW002S-R	12.67	577.65	12.09	578.23	12.45	577.87	12.35	577.97	12.38	577.94	12.27	578.05	11.81	578.51
MW031M	10.10	577.92	9.30	578.72	9.91	578.11	9.79	578.23	9.92	578.10	9.64	578.38	9.31	578.71
MW031S	11.21	577.69	10.58	578.32	11.01	577.89	10.95	577.95	11.00	577.90	10.72	578.18	10.17	578.73
MW113S	12.69	577.59	12.07	578.21	12.43	577.85	12.35	577.93	12.35	577.93	12.32	577.96	11.93	578.36
MW113M	11.38	578.91	10.90	579.39	11.11	579.18	11.11	579.18	10.92	579.37	11.05	579.24	10.62	579.68
MW115P	9.66	579.43	9.28	579.81	9.60	579.49	9.65	579.44	9.77	579.32	9.77	579.32	9.57	579.52
MW115S	11.58	577.41	10.97	578.02	11.35	577.64	11.27	577.72	11.21	577.78	11.21	577.78	10.72	578.28
MW116P	9.80	580.11	9.73	580.19	9.81	580.10	9.85	580.06	9.94	579.97	9.98	579.93	9.88	580.03
MW116S	12.31	577.59	11.70	578.20	12.11	577.79	12.02	577.88	11.99	577.91	11.91	577.99	11.50	578.40
MW119D	27.54	561.20	25.26	563.48	24.01	564.73	22.48	566.26	21.78	566.96	20.21	568.53	19.63	569.11
EW-3		-		-		-		-		-		-		-
EW-10	23.64	564.11	21.95	565.81	22.05	565.71	24.35	563.40	23.88	563.87	21.68	566.08	20.96	566.80
EW-11	23.19	564.12	22.90	564.41	23.04	564.27	23.16	564.15	26.03	561.27	27.55	559.75	26.93	560.37
EW-13	15.02	570.75	20.60	565.15	16.93	568.84	24.15	561.59	23.57	562.17	19.93	565.83	19.35	566.41
EW-14	21.30	565.41	21.18	565.53	21.18	565.53	21.55	565.16	21.87	564.83	21.68	565.02	21.05	565.66
MW034M	11.40	576.85	11.32	576.93	11.65	576.60	11.71	576.54	11.60	576.65	11.96	576.29	11.86	576.39
MW034S	11.60	576.62	11.53	576.69	11.88	576.34	11.88	576.34	11.81	576.41	12.13	576.09	11.96	576.26
MW036M	11.65	576.95	11.57	577.03	12.11	576.48	12.22	576.37	12.32	576.27	12.58	576.01	12.45	576.14
MW036S	10.92	577.35	10.84	577.43	11.39	576.88	11.49	576.78	11.70	576.57	11.94	576.33	11.89	576.38
MW038M	10.78	576.91	10.66	577.03	11.31	576.38	11.41	576.28	11.61	576.08	11.82	575.87	11.69	576.00
MW038S	10.91	576.80	10.78	576.93	11.49	576.22	11.55	576.16	11.75	575.96	12.00	575.71	11.89	575.82
MW120D	7.36	581.48	7.16	581.68	7.16	581.68	6.99	581.85	7.10	581.74	7.18	581.66	7.07	581.77
MW120M	10.84	578.13	10.71	578.27	11.03	577.94	10.73	578.25	11.31	577.66	11.55	577.41	11.44	577.52
MW120S	9.95	578.65	9.71	578.89	10.09	578.51	10.29	578.31	10.41	578.19	10.74	577.86	10.67	577.93
EW-2		-		-		-		-		-		-		-
EW-8	12.86	573.91	12.81	573.96	13.95	572.82	14.10	572.67	14.30	572.47	14.01	572.76	13.30	573.47
EW-9	20.94	564.74	19.21	566.47	15.27	570.42	20.38	565.30	20.03	565.65	19.92	565.76	19.31	566.37
MW004M		-		-		-		-		-		-		-
MW004S	5.53	583.05	5.01	583.57	5.06	583.52	5.28	583.30	5.27	583.31	5.42	583.16	5.36	583.22
MW032M	6.23	582.00	5.64	582.59	5.73	582.50	5.90	582.33	5.90	582.33	6.02	582.21	5.66	582.57
MW032S	9.70	578.65	9.26	579.09	8.97	579.38	8.69	579.66	8.58	579.77	8.21	580.15	7.86	580.50
MW033M	4.67	584.13	4.07	584.74	4.15	584.66	4.37	584.44	4.38	584.43	4.52	584.28	4.39	584.42
MW033S	4.25	582.92	3.72	583.45	3.76	583.41	3.97	583.20	3.97	583.20	4.09	583.08	4.01	583.16
MW039M		-		-		-		-		-		-		-
MW039S	2.98	583.11	2.41	583.68	2.48	583.61	2.68	583.41	2.71	583.38	2.88	583.21	2.72	583.37
MW035M		-		-		-		-		-		-		-
MW035S	6.86	580.81	5.60	582.07	5.75	581.92	5.92	581.75	5.89	581.78	5.89	581.78	5.63	582.04
MW037M		-		-		-		-		-		-		-
MW037S	6.46	580.62	4.91	582.17	5.03	582.05	5.28	581.80	5.30	581.78	5.23	581.85	4.95	582.13
SG4	7.80	581.09	7.39	581.50	7.57	581.32	6.30	582.59	7.50	581.39	7.59	581.30	7.48	581.41
Rough Target Elevation Calc SV*		577.67		578.29		577.90		577.98		578.00		578.06		578.52
Rough Target Elevation Calc 8S*		577.28		577.40		576.92		576.88		576.72		576.45		576.55
Target Elevation (NAVD88)		577.90		577.90		577.90		577.90		577.90		577.90		577.90
SV Variance		-0.23		0.39		0.00		0.08		0.10		0.16		0.62
8S Variance		-0.62		-0.50		-0.98		-1.02		-1.18		-1.45		-1.35

Well ID	July 10, 2018		July 13, 2018		July 17, 2018		July 19, 2018		July 20, 2018		July 24, 2018		July 26, 2018	
	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)
MW001M	10.02	577.15	10.28	576.89	10.44	576.73	10.29	576.88	10.13	577.04	10.22	576.95	10.10	577.07
MW001S	9.05	578.21	9.39	577.87	9.55	577.71	9.42	577.84	9.21	578.05	9.35	577.91	9.25	578.01
MW002M-R	12.09	578.61	12.43	578.26	12.62	578.07	12.49	578.20	12.23	578.47	12.38	578.31	12.39	578.30
MW002S-R	12.00	578.32	12.30	578.02	12.53	577.79	12.37	577.95	12.16	578.16	12.31	578.01	12.22	578.10
MW031M	9.20	578.82	9.78	578.24	9.98	578.04	9.91	578.11	9.75	578.27	9.90	578.12	9.75	578.27
MW031S	10.38	578.52	10.88	578.02	11.02	577.88	6.31	582.59	10.79	578.11	10.96	577.94	10.86	578.04
MW113S	11.96	578.33	12.29	577.99	12.51	577.77	12.33	577.95	12.14	578.14	12.29	577.99	12.19	578.09
MW113M	10.98	579.31	11.15	579.14	11.39	578.90	11.28	579.01	11.13	579.16	11.24	579.05	11.10	579.19
MW115P	9.38	579.71	9.84	579.25	10.14	578.95	9.95	579.14	9.76	579.33	10.10	578.99	10.07	579.02
MW115S	10.85	578.15	11.17	577.82	11.37	577.62	11.19	577.80	11.04	577.95	11.16	577.83	11.11	577.88
MW116P	9.86	580.05	9.99	579.92	10.13	579.78	10.09	579.82	10.03	579.88	10.20	579.71	10.20	579.71
MW116S	11.62	578.28	11.93	577.97	12.12	577.78	11.96	577.94	11.78	578.12	11.94	577.96	11.87	578.03
MW119D	18.24	570.50	17.51	571.23	16.67	572.07	16.29	572.45	16.02	572.72	15.28	573.46	14.96	573.78
EW-3		-		-		-		-		-		-		-
EW-10	21.61	566.15	24.22	563.53	19.68	568.08	23.51	564.24	23.20	564.55	23.14	564.62	23.42	564.33
EW-11	23.02	564.29	23.16	564.15	23.57	563.74	25.61	561.70	22.03	565.28	23.14	564.17	23.35	563.96
EW-13	23.15	562.59	21.01	564.74	22.29	563.46	23.58	562.16	21.02	564.73	23.91	561.83	23.41	562.33
EW-14	21.76	564.94	21.68	565.02	21.91	564.79	17.53	569.19	17.37	569.35	21.89	564.81	21.80	564.90
MW034M	11.98	576.27	12.28	575.97	12.43	575.82	12.56	575.69	12.57	575.68	12.70	575.55	12.75	575.50
MW034S	12.14	576.08	12.41	575.81	12.62	575.60	12.73	575.49	12.75	575.47	12.85	575.37	12.92	575.30
MW036M	12.59	576.00	13.03	575.55	13.18	575.40	13.39	575.18	13.46	575.11	13.52	575.05	13.45	575.12
MW036S	11.92	576.35	12.40	575.87	12.53	575.74	12.72	575.55	12.81	575.46	12.85	575.42	12.85	575.42
MW038M	11.82	575.87	12.39	575.30	12.45	575.24	12.77	574.92	12.85	574.84	12.76	574.93	12.65	575.04
MW038S	12.01	575.70	12.60	575.10	12.63	575.07	12.96	574.74	13.06	574.64	12.91	574.79	12.81	574.89
MW120D	7.32	581.52	7.21	581.63	7.46	581.38	7.37	581.47	7.17	581.67	7.33	581.51	7.52	581.32
MW120M	11.64	577.32	11.82	577.14	12.07	576.88	12.12	576.83	12.13	576.82	12.31	576.64	12.40	576.55
MW120S	10.83	577.77	10.95	577.65	11.33	577.27	11.29	577.31	11.18	577.42	11.51	577.08	11.60	576.99
EW-2		-		-		-		-		-		-		-
EW-8	14.21	572.56	15.68	571.08	15.84	570.92	17.32	569.44	17.32	569.44	17.85	568.91	10.76	576.02
EW-9	19.95	565.73	19.90	565.78	20.38	565.30	20.59	565.09	20.45	565.23	19.92	565.76	20.76	564.92
MW004M		-		-		-		-		-		-		-
MW004S	5.48	583.10	5.50	583.08	5.69	582.89	5.73	582.85	5.65	582.93	5.80	582.78	5.70	582.88
MW032M	6.13	582.10	6.04	582.19	6.29	581.94	7.22	581.00	6.24	581.99	6.26	581.97	6.23	582.00
MW032S	7.66	580.70	7.53	580.83	7.32	581.04	10.97	577.38	7.19	581.17	7.02	581.34	7.00	581.36
MW033M	4.59	584.21	4.65	584.15	4.83	583.97	4.86	583.94	4.81	583.99	4.90	583.90	4.85	583.95
MW033S	4.20	582.97	4.24	582.93	4.41	582.76	4.49	582.68	4.46	582.71	4.54	582.63	4.46	582.71
MW039M		-		-		-		-		-		-		-
MW039S	2.96	583.13	2.95	583.14	3.16	582.93	3.21	582.88	3.11	582.98	3.24	582.85	3.13	582.96
MW035M		-		-		-		-		-		-		-
MW035S	6.17	581.50	6.27	581.40	7.01	580.66	7.15	580.52	7.01	580.66	7.15	580.52	6.59	581.08
MW037M		-		-		-		-		-		-		-
MW037S	5.57	581.51	5.78	581.30	6.58	580.49	6.79	580.28	6.64	580.43	6.83	580.24	6.15	580.93
SG4	6.75	582.14	6.70	582.19	7.47	581.42	7.80	581.09	7.03	581.86	7.7	581.19	7	581.89
Rough Target Elevation Calc SV*		578.37		578.02		577.83		578.43		578.15		578.01		578.10
Rough Target Elevation Calc 8S*		576.42		576.05		575.88		575.71		575.68		575.60		575.60
Target Elevation (NAVD88)		577.90		577.90		577.90		577.90		577.90		577.90		577.90
SV Variance		0.47		0.12		-0.07		0.53		0.25		0.11		0.20
8S Variance		-1.48		-1.85		-2.02		-2.19		-2.22		-2.30		-2.30

Well ID	July 31, 2018		August 2, 2018		August 7, 2018		August 9, 2018		August 14, 2018		August 16, 2018		August 21, 2018	
	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)
MW001M	10.23	576.94	10.22	576.95	10.23	576.94	10.20	576.97	10.11	577.06	10.20	576.97	10.21	576.96
MW001S	9.38	577.88	9.34	577.92	9.28	577.98	9.28	577.98	9.22	578.04	9.30	577.96	9.27	577.99
MW002M-R	12.40	578.29	12.42	578.27	12.39	578.30	12.38	578.31	12.30	578.39	12.41	578.28	12.37	578.32
MW002S-R	12.33	577.99	12.29	578.03	12.33	577.99	12.30	578.02	12.25	578.07	12.35	577.97	12.28	578.04
MW031M	9.83	578.19	9.82	578.20	9.76	578.26	9.73	578.29	9.78	578.24	9.82	578.20	9.72	578.30
MW031S	10.94	577.96	10.84	578.06	10.86	578.04	10.87	578.03	10.89	578.01	10.88	578.02	10.88	578.02
MW113S	12.31	577.97	12.29	577.99	12.34	577.94	12.27	578.01	12.24	578.04	12.31	577.97	12.24	578.04
MW113M	11.23	579.06	11.21	579.08	11.29	579.00	11.28	579.01	11.30	578.99	11.33	578.96	11.29	579.00
MW115P	10.20	578.89	10.24	578.85	10.23	578.86	10.21	578.88	10.20	578.89	10.30	578.79	10.28	578.81
MW115S	11.17	577.82	11.18	577.81	11.16	577.83	11.15	577.84	11.10	577.89	11.20	577.79	11.09	577.90
MW116P	10.26	579.65	10.29	579.62	8.32	581.60	10.38	579.53	10.35	579.56	10.41	579.50	10.42	579.49
MW116S	11.91	577.99	11.93	577.97	11.88	578.02	11.91	577.99	11.83	578.07	11.95	577.95	11.85	578.05
MW119D	14.16	574.58	13.90	574.84	13.25	575.49	13.02	575.72	12.45	576.29	12.26	576.48	11.74	577.00
EW-3		-		-		-		-		-		-		-
EW-10	23.42	564.33	23.60	564.15	23.11	564.65	22.17	565.59	24.05	563.70	24.32	563.43	23.84	563.91
EW-11	22.42	564.89	27.42	559.88	28.48	558.82	28.03	559.27	28.30	559.00	28.41	558.89	28.04	559.26
EW-13	22.38	563.37	23.84	561.90	23.78	561.96	23.91	561.83	22.87	562.87	18.69	567.07	24.21	561.53
EW-14	21.55	565.16	21.45	565.26	21.53	565.18	21.82	564.88	21.86	564.84	22.02	564.68	21.72	564.98
MW034M	12.74	575.51	12.81	575.44	12.84	575.41	13.03	575.22	13.22	575.03	13.29	574.96	13.33	574.92
MW034S	12.91	575.31	13.03	575.19	13.03	575.19	13.25	574.97	13.42	574.80	13.46	574.76	13.49	574.73
MW036M	13.47	575.10	13.69	574.88	13.58	574.99	13.82	574.74	13.86	574.70	14.00	574.56	13.82	574.74
MW036S	12.89	575.38	13.09	575.18	13.00	575.27	13.25	575.02	13.30	574.97	13.41	574.86	13.31	574.96
MW038M	12.67	575.02	13.06	574.63	12.89	574.80	13.11	574.58	13.14	574.55	13.30	574.39	12.93	574.76
MW038S	12.82	574.88	13.25	574.45	13.07	574.63	13.35	574.35	13.29	574.41	13.47	574.23	13.04	574.66
MW120D	7.29	581.55	7.26	581.58	7.56	581.28	7.38	581.46	7.41	581.43	7.36	581.48	7.46	581.38
MW120M	12.49	576.46	11.44	577.52	12.62	576.32	12.80	576.14	12.91	576.03	13.02	575.92	13.18	575.75
MW120S	11.79	576.80	11.89	576.70	11.96	576.63	12.05	576.54	12.16	576.43	12.29	576.30	12.45	576.14
EW-2		-		-		-		-		-		-		-
EW-8	17.11	569.65	17.43	569.33	16.92	569.84	17.08	569.68	18.31	568.45	18.34	568.42	17.82	568.94
EW-9	17.05	568.63	16.47	569.22	16.46	569.23	16.55	569.14	20.82	564.86	21.67	564.00	21.22	564.46
MW004M		-		-		-		-		-		-		-
MW004S	5.88	582.70	5.93	582.65	6.06	582.52	6.13	582.45	6.25	582.33	6.32	582.26	6.42	582.16
MW032M	6.36	581.87	6.43	581.79	6.46	581.76	6.52	581.70	6.60	581.62	6.66	581.56	6.62	581.60
MW032S	6.83	581.53	6.78	581.58	6.80	581.56	6.63	581.73	6.55	581.81	6.55	581.81	6.52	581.84
MW033M	5.03	583.76	5.06	583.73	5.17	583.62	5.23	583.56	5.34	583.45	5.41	583.38	5.49	583.30
MW033S	4.67	582.50	4.72	582.45	4.60	582.57	4.87	582.30	5.00	582.17	5.04	582.13	5.16	582.01
MW039M		-		-		-		-		-		-		-
MW039S	3.97	582.12	3.41	582.68	3.48	582.61	3.59	582.50	3.70	582.39	3.76	582.33	3.87	582.22
MW035M		-		-		-		-		-		-		-
MW035S	7.27	580.40	7.33	580.34	7.53	580.14	7.65	580.02	7.93	579.74	8.03	579.64	7.98	579.69
MW037M		-		-		-		-		-		-		-
MW037S	6.92	580.15	6.96	580.11	7.15	579.92	7.33	579.74	7.58	579.49	7.68	579.39	7.65	579.42
SG4	6.7433	582.15	7.16	581.73	7.81	581.08	7.65	581.24	7.60	581.29	7.50	581.39	7.66	581.23
Rough Target Elevation Calc SV*		578.01		578.03		578.03		578.05		578.08		578.01		578.06
Rough Target Elevation Calc 8S*		575.56		575.50		575.41		575.20		575.12		575.00		575.08
Target Elevation (NAVD88)		577.90		577.90		577.90		577.90		577.90		577.90		577.90
SV Variance		0.11		0.13		0.13		0.15		0.18		0.11		0.16
8S Variance		-2.34		-2.40		-2.49		-2.70		-2.78		-2.90		-2.82

Well ID	August 23, 2018		August 28, 2018		August 30, 2018		September 4, 2018		September 6, 2018		September 11, 2018		September 13, 2018	
	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)
MW001M	10.18	576.99	8.08	579.09	10.23	576.94	10.06	577.11	10.17	577.00	9.74	577.43	9.87	577.30
MW001S	9.32	577.94	9.19	578.07	9.37	577.89	9.20	578.06	9.41	577.85	8.79	578.47	8.89	578.37
MW002M-R	12.43	578.26	12.33	578.36	12.48	578.21	12.34	578.35	12.50	578.19	11.88	578.82	12.08	578.62
MW002S-R	12.34	577.98	12.26	578.06	12.44	577.88	12.22	578.10	12.42	577.90	11.78	578.54	11.98	578.34
MW031M	9.84	578.18	9.65	578.37	9.89	578.13	9.78	578.24	9.81	578.21	9.31	578.71	9.43	578.59
MW031S	10.94	577.96	10.79	578.11	11.04	577.86	10.90	578.00	11.01	577.89	10.40	578.50	10.53	578.37
MW113S	12.29	577.99	12.22	578.06	12.36	577.92	12.22	578.06	12.39	577.89	11.75	578.54	11.95	578.34
MW113M	11.40	578.89	11.26	579.03	11.35	578.94	11.22	579.07	11.29	579.00	10.25	580.05	11.13	579.16
MW115P	10.39	578.70	10.35	578.74	10.61	578.48	10.41	578.68	10.58	578.51	10.23	578.86	10.31	578.78
MW115S	11.18	577.81	11.03	577.96	11.24	577.75	11.08	577.91	11.25	577.74	10.43	578.57	10.62	578.38
MW116P	10.48	579.43	10.53	579.38	10.56	579.35	10.55	579.36	10.66	579.25	10.61	579.30	10.65	579.26
MW116S	11.95	577.95	11.78	578.12	11.97	577.93	11.81	578.09	11.98	577.92	11.34	578.56	11.53	578.37
MW119D	11.62	577.12	11.24	577.50	11.09	577.65	10.74	578.00	10.59	578.15	10.28	578.46	59.68	529.06
EW-3		-		-		-		-		-		-		-
EW-10	28.22	559.52	22.31	565.45	23.63	564.12	23.19	564.56	23.91	563.84	23.86	563.89	23.66	564.09
EW-11	23.93	563.38	23.82	563.49	23.05	564.26	26.49	560.81	22.86	564.45	28.13	559.17	28.08	559.22
EW-13	23.98	561.76	23.73	562.01	24.08	561.66	19.65	566.11	22.77	562.97	6.52	579.29	6.64	579.16
EW-14	21.63	565.07	21.22	565.49	21.63	565.07	21.56	565.15	19.55	567.16	7.82	578.95	7.69	579.08
MW034M	13.41	574.84	13.42	574.83	13.51	574.74	13.50	574.75	13.58	574.67	13.64	574.61	13.69	574.56
MW034S	13.58	574.64	13.61	574.61	13.68	574.54	13.69	574.53	13.75	574.47	13.86	574.36	13.92	574.30
MW036M	14.06	574.50	14.03	574.53	14.21	574.35	13.98	574.58	14.22	574.34	14.33	574.22	14.43	574.12
MW036S	13.51	574.76	13.51	574.76	13.64	574.63	13.48	574.79	13.69	574.58	13.78	574.49	13.88	574.39
MW038M	13.31	574.38	13.19	574.50	13.51	574.18	13.00	574.69	13.41	574.28	13.52	574.17	13.68	574.01
MW038S	13.43	574.27	13.32	574.38	13.65	574.05	13.13	574.57	13.55	574.15	13.63	574.07	13.84	573.86
MW120D	7.61	581.22	7.37	581.47	7.48	581.36	7.16	581.68	7.19	581.65	7.13	581.71	7.33	581.51
MW120M	13.19	575.74	13.23	575.70	13.26	575.67	13.38	575.55	13.43	575.50	13.52	575.41	13.61	575.32
MW120S	12.51	576.08	12.58	576.01	12.66	575.93	12.71	575.88	12.82	575.77	12.87	575.72	12.92	575.67
EW-2		-		-		-		-		-		-		-
EW-8	17.66	569.10	11.42	575.35	17.15	569.61	14.45	572.32	17.24	569.52	17.62	569.14	11.98	574.79
EW-9	22.02	563.65	19.86	565.82	21.08	564.60	20.32	565.36	19.88	565.80	22.35	563.32	22.44	563.23
MW004M		-		-		-		-		-		-		-
MW004S	6.49	582.09	6.29	582.29	6.24	582.34	6.10	582.48	6.04	582.54	6.06	582.52	6.15	582.43
MW032M	6.79	581.43	6.51	581.71	6.77	581.45	6.34	581.89	6.26	581.97	6.28	581.95	6.39	581.83
MW032S	6.51	581.85	6.46	581.90	6.67	581.69	6.32	582.04	6.29	582.07	6.17	582.19	6.16	582.20
MW033M	5.56	583.22	5.39	583.40	5.30	583.49	5.21	583.58	5.07	583.72	5.13	583.66	5.19	583.60
MW033S	5.21	581.96	5.06	582.11	4.94	582.23	4.89	582.28	4.73	582.44	4.78	582.39	4.85	582.32
MW039M		-		-		-		-		-		-		-
MW039S	3.96	582.13	3.71	582.38	3.69	582.40	3.56	582.53	3.48	582.61	3.58	582.51	3.62	582.47
MW035M		-		-		-		-		-		-		-
MW035S	8.32	579.35	7.11	580.56	7.11	580.56	6.62	581.05	6.20	581.47	6.92	580.75	7.12	580.55
MW037M		-		-		-		-		-		-		-
MW037S	7.91	579.16	6.59	580.48	6.59	580.48	6.05	581.03	5.69	581.39	6.49	580.59	6.68	580.39
SG4	7.86	581.03	7.59	581.30	7.75	581.14	7.49	581.40	6.74	582.15	8.34	580.55	7.83	581.06
Rough Target Elevation Calc SV*		578.00		578.32		577.95		578.10		577.96		578.62		578.38
Rough Target Elevation Calc 8S*		574.90		574.92		574.76		574.92		574.72		574.63		574.53
Target Elevation (NAVD88)		577.90		577.90		577.90		577.90		577.90		577.90		577.90
SV Variance		0.10		0.42		0.05		0.20		0.06		0.72		0.48
8S Variance		-3.00		-2.98		-3.14		-2.98		-3.18		-3.27		-3.37

Well ID	September 18, 2018		September 20, 2018		September 25, 2018		September 27, 2018		October 2, 2018		October 4, 2018		October 9, 2018	
	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)
MW001M	9.72	577.45	9.75	577.42	10.10	577.07	10.10	577.07	10.08	577.09	10.32	576.85	9.95	577.22
MW001S	8.82	578.44	8.89	578.37	9.18	578.08	9.21	578.05	9.28	577.98	9.52	577.74	9.06	578.20
MW002M-R	11.92	578.78	11.99	578.71	12.31	578.38	12.28	578.41	12.36	578.33	12.59	578.10	12.14	578.56
MW002S-R	11.88	578.44	11.90	578.42	12.22	578.10	12.19	578.13	12.27	578.05	12.51	577.81	12.10	578.22
MW031M	9.25	578.77	9.43	578.59	9.72	578.30	9.72	578.30	9.73	578.29	9.73	578.29	9.57	578.45
MW031S	10.38	578.52	10.49	578.41	10.82	578.08	10.85	578.05	10.83	578.07	11.05	577.85	10.71	578.19
MW113S	11.83	578.46	11.86	578.43	12.16	578.12	12.18	578.10	12.21	578.07	12.47	577.81	12.02	578.27
MW113M	11.06	579.23	11.10	579.19	11.07	579.22	11.29	579.00	11.23	579.06	11.35	578.94	10.79	579.51
MW115P	10.17	578.92	10.21	578.88	10.46	578.63	10.45	578.64	10.54	578.55	10.74	578.35	10.47	578.62
MW115S	10.48	578.52	10.51	578.49	11.05	577.94	10.98	578.01	11.02	577.97	11.24	577.75	10.89	578.10
MW116P	10.59	579.32	10.61	579.30	10.68	579.23	10.67	579.24	10.76	579.15	10.88	579.03	10.83	579.08
MW116S	11.39	578.51	11.38	578.52	11.79	578.11	11.78	578.12	11.84	578.06	12.06	577.84	11.67	578.23
MW119D	54.23	534.51	52.25	536.49	48.19	540.55	45.52	543.22	41.28	547.46	39.78	548.96	36.05	552.69
EW-3		-		-		-		-		-		-		-
EW-10	23.61	564.14	23.38	564.37	23.33	564.42	23.42	564.33	23.56	564.19	23.73	564.02	23.90	563.85
EW-11	25.02	562.29	26.35	560.95	26.30	561.00	26.33	560.97	27.06	560.24	27.74	559.56	27.04	560.26
EW-13	6.61	579.20	6.61	579.20	22.61	563.14	22.38	563.37	24.16	561.58	24.18	561.56	24.08	561.66
EW-14	7.61	579.16	7.62	579.15	20.84	565.87	20.95	565.76	21.22	565.49	21.28	565.43	21.13	565.58
MW034M	13.76	574.49	13.80	574.45	13.79	574.46	13.88	574.37	13.97	574.28	13.98	574.27	13.86	574.39
MW034S	13.96	574.26	13.05	575.17	14.04	574.18	14.13	574.09	14.27	573.95	14.24	573.98	14.23	573.99
MW036M	14.51	574.04	14.54	574.01	14.59	573.96	14.68	573.87	14.72	573.83	14.81	573.74	14.83	573.72
MW036S	13.98	574.29	14.04	574.23	14.14	574.13	14.18	574.09	14.25	574.02	14.28	573.99	14.35	573.92
MW038M	13.78	573.91	13.82	573.87	13.82	573.87	13.89	573.80	13.93	573.76	14.01	573.68	14.02	573.67
MW038S	13.91	573.79	13.95	573.75	13.97	573.73	14.04	573.66	14.08	573.62	14.12	573.58	14.21	573.49
MW120D	7.14	581.70	7.16	581.68	7.25	581.59	7.51	581.33	7.37	581.47	8.09	580.74	6.99	581.85
MW120M	13.65	575.28	13.74	575.18	13.83	575.09	13.85	575.07	14.02	574.90	14.04	574.88	14.00	574.92
MW120S	13.00	575.59	13.02	575.57	13.16	575.43	13.21	575.38	13.32	575.27	13.44	575.15	13.42	575.17
EW-2		-		-		-		-		-		-		-
EW-8	17.47	569.29	17.87	568.89	17.81	568.95	17.78	568.98	18.29	568.47	17.98	568.78	18.47	568.29
EW-9	17.58	568.10	20.45	565.23	20.39	565.29	20.51	565.17	20.79	564.89	22.29	563.38	20.27	565.41
MW004M		-		-		-		-		-		-		-
MW004S	6.25	582.33	6.29	582.29	6.34	582.24	6.36	582.22	6.29	582.29	6.18	582.40	5.79	582.79
MW032M	6.45	581.77	6.47	581.75	6.44	581.78	6.47	581.75	6.46	581.76	6.48	581.74	5.92	582.31
MW032S	6.12	582.24	6.14	582.22	6.12	582.24	6.13	582.23	6.16	582.20	6.18	582.18	6.11	582.25
MW033M	5.30	583.49	5.38	583.41	5.38	583.41	5.39	583.40	5.34	583.45	5.21	583.58	5.29	583.50
MW033S	4.95	582.22	5.02	582.15	5.05	582.12	5.03	582.14	5.02	582.15	4.81	582.36	4.98	582.19
MW039M		-		-		-		-		-		-		-
MW039S	3.72	582.37	3.74	582.35	3.79	582.30	3.81	582.28	3.74	582.35	3.57	582.52	3.21	582.88
MW035M		-		-		-		-		-		-		-
MW035S	7.39	580.28	7.35	580.32	7.36	580.31	7.48	580.19	6.98	580.69	6.07	581.60	5.57	582.10
MW037M		-		-		-		-		-		-		-
MW037S	6.98	580.09	6.89	580.18	6.94	580.13	7.01	580.06	6.46	580.62	5.31	581.77	4.90	582.18
SG4	7.50	581.39	6.99	581.90	7.50	581.39	7.65	581.24	7.82	581.07	8.50	580.39	7.15	581.74
Rough Target Elevation Calc SV*		578.51		578.45		578.14		578.13		578.10		577.90		578.29
Rough Target Elevation Calc 8S*		574.46		574.53		574.36		574.29		574.20		574.16		574.16
Target Elevation (NAVD88)		577.90		577.90		577.90		577.90		577.90		577.90		577.90
SV Variance		0.61		0.55		0.24		0.23		0.20		0.00		0.39
8S Variance		-3.44		-3.37		-3.54		-3.61		-3.70		-3.74		-3.74

Tabke 14. 2016-2018 Pump Down Program Groundwater Elevation Monitoring
Tyco Fire Products LP, Marinette, Wisconsin

Target Elevation	577.9

Well ID	October 11, 2018		October 16, 2018		October 18, 2018		October 23, 2018		October 25, 2018		October 30, 2018		November 1, 2018		November 5, 2018	
	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)	DTW	Corrected Groundwater Elevation (for equivalent fresh water)
MW001M	9.88	577.29	9.91	577.26	10.26	576.91	10.23	576.94	10.10	577.07	10.06	577.11	10.15	577.02	10.00	577.17
MW001S	9.10	578.16	8.16	579.10	9.43	577.83	9.43	577.83	9.25	578.01	9.26	578.00	9.34	577.92	9.24	578.02
MW002M-R	12.01	578.69	12.20	578.50	12.55	578.14	12.49	578.20	12.34	578.35	12.38	578.31	12.48	578.21	12.33	578.36
MW002S-R	12.07	578.25	12.06	578.26	12.43	577.89	12.42	577.90	12.26	578.06	12.30	578.02	12.39	577.93	12.20	578.12
MW031M	9.37	578.65	9.65	578.37	9.94	578.08	9.81	578.21	9.83	578.19	9.82	578.20	9.85	578.17	9.65	578.37
MW031S	10.51	578.39	10.75	578.15	11.10	577.80	10.97	577.93	10.93	577.97	10.98	577.92	10.95	577.95	10.72	578.18
MW113S	11.89	578.40	12.05	578.24	12.42	577.86	12.40	577.88	12.21	578.07	12.25	578.03	12.34	577.94	12.06	578.22
MW113M	10.57	579.73	11.09	579.20	11.26	579.03	11.19	579.10	11.16	579.13	11.21	579.08	11.22	579.07	10.96	579.33
MW113P	10.38	578.71	10.49	578.60	10.82	578.27	10.76	578.33	10.70	578.39	10.66	578.43	10.74	578.35	10.59	578.50
MW115S	10.73	578.27	10.90	578.09	11.28	577.71	11.25	577.74	11.11	577.88	11.12	577.87	11.21	577.78	11.00	577.99
MW116P	10.87	579.04	10.85	579.06	10.98	578.93	10.99	578.92	10.91	579.00	10.99	578.92	11.02	578.89	10.97	578.94
MW116S	11.57	578.33	11.68	578.22	12.01	577.89	12.04	577.86	11.86	578.04	11.88	578.02	11.95	577.95	11.76	578.14
MW119D	36.28	552.46	31.64	557.10	30.53	558.21	27.93	560.81	26.90	561.84	27.74	561.00	23.95	564.79	22.40	566.34
EW-3		-		-		-		-		-		-		-		-
EW-10	23.84	563.91	23.10	564.66	22.60	565.16	24.18	563.57	21.93	565.83	24.74	563.01	23.72	564.03	17.79	569.98
EW-11	27.12	560.18	23.30	564.01	23.41	563.90	22.15	565.16	25.65	561.66	21.82	565.49	21.80	565.51	28.07	559.23
EW-13	24.01	561.73	21.95	563.80	23.22	562.52	23.66	562.08	20.78	564.97	23.30	562.44	21.78	563.97	23.14	562.60
EW-14	21.20	565.51	20.89	565.82	20.42	566.29	20.50	566.21	19.95	566.76	20.29	566.42	20.24	566.47	20.35	566.36
MW034M	13.79	574.46	13.09	575.16	13.15	575.10	14.19	574.06	14.23	574.02	14.28	573.97	14.28	573.97	14.28	573.97
MW034S	14.16	574.06	13.36	574.86	14.47	573.75	14.49	573.73	14.54	573.68	14.60	573.62	14.61	573.61	14.63	573.59
MW036M	14.84	573.71	14.09	574.47	14.93	573.61	15.02	573.52	15.02	573.52	15.08	573.46	15.10	573.44	15.11	573.43
MW036S	14.39	573.88	14.32	573.95	14.40	573.87	14.52	573.75	14.54	573.73	14.61	573.66	14.61	573.66	14.64	573.63
MW038M	14.03	573.66	13.96	573.73	14.11	573.58	14.20	573.49	14.20	573.49	14.24	573.45	14.28	573.41	14.25	573.44
MW038S	14.19	573.51	14.05	573.65	14.24	573.46	14.33	573.37	14.34	573.36	14.38	573.32	14.40	573.30	14.36	573.34
MW120D	7.01	581.83	7.87	580.96	7.89	580.94	7.49	581.35	7.71	581.12	7.59	581.24	7.70	581.13	7.27	581.57
MW120M	14.02	574.90	14.21	574.71	14.19	574.73	14.25	574.67	14.34	574.57	14.38	574.53	14.43	574.48	14.48	574.43
MW120S	13.45	575.14	14.44	574.15	13.55	575.04	13.67	574.92	13.65	574.94	13.75	574.84	13.82	574.77	13.81	574.78
EW-2		-		-		-		-		-		-		-		-
EW-8	18.52	568.24	16.95	569.81	17.80	568.96	17.76	569.00	16.20	570.56	17.96	568.80	17.93	568.83	12.24	574.53
EW-9	20.30	565.38	20.49	565.19	20.30	565.38	22.62	563.05	22.14	563.53	22.11	563.56	21.10	564.58	21.72	563.95
MW004M		-		-		-		-		-		-		-		-
MW004S	5.46	583.12	5.27	583.31	5.41	583.17	5.48	583.10	5.50	583.08	5.55	583.03	5.61	582.97	5.45	583.13
MW032M	5.73	582.50	5.94	582.29	6.12	582.11	6.11	582.12	6.10	582.13	6.21	582.02	6.20	582.03	5.86	582.37
MW032S	6.08	582.28	5.95	582.41	6.00	582.36	5.89	582.47	5.88	582.48	5.85	582.51	5.81	582.55	5.78	582.58
MW033M	4.44	584.36	4.32	584.49	4.49	584.31	4.56	584.24	4.57	584.23	4.61	584.19	4.69	584.11	4.50	584.30
MW033S	4.09	583.08	3.95	583.22	4.10	583.07	4.13	583.04	4.21	582.96	4.25	582.92	4.31	582.86	4.13	583.04
MW039M		-		-		-		-		-		-		-		-
MW039S	2.85	583.24	2.70	583.39	2.84	583.25	2.92	583.17	2.95	583.14	2.96	583.13	3.02	583.07	2.88	583.21
MW035M		-		-		-		-		-		-		-		-
MW035S	5.61	582.06	5.71	581.96	5.83	581.84	5.93	581.74	5.92	581.75	5.91	581.76	6.00	581.67	5.68	581.99
MW037M		-		-		-		-		-		-		-		-
MW037S	4.88	582.20	4.98	582.10	5.07	582.01	5.15	581.93	5.17	581.91	5.21	581.87	5.25	581.83	5.04	582.04
SG4	7.95	580.94	8.20	580.69	8.24	580.65	7.80	581.09	8.06	580.83	7.70	581.19	8.20	580.69	8.50	580.39
Rough Target Elevation Calc SV*		578.41		578.34		577.91		577.96		578.08		578.06		577.99		578.19
Rough Target Elevation Calc 8S*		574.16		574.33		574.14		573.94		573.91		573.86		573.83		573.83
Target Elevation (NAVD88)		577.90		577.90		577.90		577.90		577.90		577.90		577.90		577.90
SV Variance		0.51		0.44		0.01		0.06		0.18		0.16		0.09		0.29
8S Variance		-3.74		-3.57		-3.76		-3.96		-3.99		-4.04		-4.07		-4.07

Notes:
Measurements were collected from top of casing (TOC). All depth measurements are in feet.
Elevations are reported in feet above mean sea level (AMSL) relative top the North American Vertical Datum 1988 (NAVD88)
Shaded = Well part of evaluation during Drawdown and Interim Phases
Bold = Well part of Target Elevation calculation
- = Information not applicable or not collected
Area Definitions - SV - Salt Vault, 8S - 8th Street Slip

*Wells identified for target elevation calculation are for during the drawdown and interim phases. Only wells outside the steepest portion of the cone of depression will be included in the calculation of the average elevations. The average elevation of all suitable measured wells will be considered the calculated elevation to compare against the target elevation. The number of post-drawdown phase wells used for this calculation may be reduced and will be determined based on results observed during the drawdown phase.

ID = identification; DTW = depth to water
NM = Not Measured; MW = Monitoring Well

Table 15. Summary of Sediment Sample Locations and Field and Laboratory Data

Tyco Fire Products LP, Marinette, Wisconsin

Sample ID	Location	Proposed Location		Actual Location		Water Elevation, ft NAVD88	Water Depth, ft	Depth to Refusal, ft	Vibracore End Depth, ft bss	Vibracore Recovery, ft	Sed Layer, ft	Sed Sample Interval, ft bss	Sed Total Arsenic, mg/kg	Sed Sample Collection Method	Sand Cover Interval, ft bss	USEPA Split Sample Interval (ft) and Matrix	USEPA Sed Total Arsenic, mg/kg	Intervals On Hold	Hold Samples Total Arsenic, mg/kg	Estimated Sedimentation Rates, in/year	Comments
		Easting	Northing	Easting	Northing																
SD-01	Main Channel	2584415.08	470615.58	2584410.58	470611.02	581.11	17.50	17.50	0.00	0.00	-	-	-	-	-	-	-	-	-	0	No recovery
SD-01B	Main Channel	-	-	2584346.81	470631.49	581.23	19.00	20.50	1.50	1.55	0.00	-	-	-	-	1.0 - 1.55, native material	**79**	0-0.5 0.5-1 1-1.55	**84** **48** **29**	0	No sediment, native undredged material
SD-02	Main Channel	2584659.42	470540.11	2584658.71	470531.73	581.16	20.30	22.20	1.90	1.25	0.00	-	-	-	-	0.8 - 1.25, native material	ND	0.4-0.8 0.8-1.25	-	0	No sediment, native undredged material
SD-03	Main Channel	2584898.07	470456.49	2584896.35	470452.88	581.35	22.00	23.00	1.00	1.35	0.00	-	-	-	-	0.9 - 1.35, native material	ND	0.4-0.9 & MS/MSD 0.9-1.35	-	0	No sediment, native undredged material
SD-04	Main Channel	2585634.04	470296.31	2585637.35	470297.33	581.09	27.50	29.50	2.00	0.65	0.10	0.0 - 0.1	2.6 J*	Ponar	0.1 - 0.65	0.1 - 0.65, sand cover	ND	0.1-0.65	-	0.4	
SD-05	Turning Basin	2584996.55	470238.72	2584994.42	470239.12	581.09	17.00	17.20	0.20	0.00	-	-	-	-	-	-	-	-	-		No recovery
SD-05B	Turning Basin	-	-	2585058.28	470313.50	581.11	27.90	30.50	2.60	1.37	1.00	0.0 - 0.5 0.5 - 1.0	**41** **85**	Vibracore	no	0.5 - 1.0, sediment	**120**	None	-	3	
SD-06	Turning Basin	2585109.75	470215.15	2585106.36	470211.13	581.13	26.60	28.00	1.40	0.0 (ponar)	<0.5	0.0 - 0.5**	**45**	Ponar	no	0.0 - 0.5, sediment	**54**	0-0.5, Dup	-	<1.5	
SD-07	Turning Basin	2585246.82	470295.69	2585250.54	470289.99	581.02	25.50	26.40	0.90	0.00	-	-	-	-	-	-	-	-	-		No recovery
SD-07B	Turning Basin	-	-	2585196.46	470311.47	581.11	27.90	29.10	1.20	0.0 (ponar)	<0.5	0.0 - 0.5**	17	Ponar	no	0.0 - 0.5, sediment	**25**	None	-	<1.5	
SD-08	Turning Basin	2584964.27	470065.70	2584965.57	470064.08	581.04	13.70	15.90	2.20	1.10	0.20	0.0 - 0.2	2.8	Ponar	0.7 - 1.2	0.7 - 1.2, sand cover	ND	0.2-0.7 0.7-1.2	-	0.8	
SD-09	Turning Basin	2585122.29	470049.57	2585124.70	470049.31	580.99	26.00	28.00	2.00	2.30	0.30	0.0 - 0.3	**380**	Ponar	no	1.6 - 2.3, native material	**2600**	0-0.3, Dup 0.3-0.8 0.8-1.3 1.3-1.8 1.8-2.3	- **310** **1500** **3700** [illegible]	0.9	
SD-10	Turning Basin	2585225.34	470122.94	2585230.53	470120.26	580.96	26.40	28.50	2.10	1.50	0.40	0.0 - 0.4	9.0	Ponar	0.4 - 0.9	0.4 - 0.9, sand cover	**47.0**	0.4-0.9	-	1.6	
SD-11	Turning Basin	2585493.49	470166.30	2585504.22	470152.51	580.99	30.00	31.40	1.40	1.20	0.50	0.0 - 0.5	**26**	Ponar	no	0.0 - 0.5, sediment	**23**	None	-	1.5	
SD-12	Turning Basin	2585012.46	469945.01	2585016.57	469944.68	581.02	16.00	17.50	1.50	1.04	0.14	0.0 - 0.14	3.2	Vibracore	0.14 - 1.04	0.64 - 1.04, sand cover	**51**	0.14-0.64 0.64-1.04	**120** -	0.6	
SD-13	Turning Basin	2585333.81	470022.19	2585339.34	470019.00	581.12	23.90	26.10	2.20	2.30	0.05	0.0 - 0.05	15	Ponar	no	2.0 - 2.3, native material	**320**	0.5-1.0 1.05-1.5 1.5-2.0 2.0-2.3	**150** **77** **190** [illegible]	0.2	
SD-14	Turning Basin	2585440.93	469947.94	2585447.63	469949.95	581.31	30.60	33.90	3.30	1.95	0.30	0.0 - 0.3	11	Ponar	0.3 - 1.7	1.2 - 1.7, sand cover	ND	0.3-0.8 0.8-1.2 1.2-1.7	-	1.2	
SD-15	Turning Basin	2585215.37	469902.49	2585221.23	469898.31	580.97	20.40	23.00	2.60	2.60	0.09	0.0 - 0.09	5.7	Ponar	0.09 - 0.68	0.09 - 0.68, sand cover	ND	0-0.09, Dup 0.09-0.68	-	0.4	
SD-16	Turning Basin	2585624.28	469850.53	2585632.50	469852.40	581.06	25.60	27.10	1.50	1.30	0.12	0.0 - 0.12	2.5 J*	Ponar	0.12 - 1.3	0.7 - 1.3, sand cover	ND	0.12-0.7 0.7-1.3	-	0.5	
SD-17	Turning Basin	2585862.00	469605.00	2585866.97	469608.66	580.99	10.10	12.60	2.50	1.75	0.75	0.0 - 0.5 0.5 - 0.98	1.7 3.8	Vibracore	0.75 - 1.48	0.98 - 1.48, sand cover	ND	0.98-1.48	-	3.0	
SD-18	Turning Basin	2585706.00	469824.00	2585720.06	469827.24	580.95	24.00	27.00	3.00	0 (ponar)	<0.5	0.0 - 0.5**	**210**	Ponar	no	0.0 - 0.5, sediment	**250**	**None**	-	<1.5	No recovery due to loss of vibracore***

Notes:
- = not applicable
in = inches
ft = feet
Sed = sediment
bss = below sediment surface
Elevations are reported in feet above mean sea level relative to the North American Vertical Datum 1988 (NAVD88
Coordinates are in NAD 83 State Plane Wisconsin Central - Survey Feet
Alphanumeric Sample IDs are field determined offset locations for primary locations with no recovery
(ponar) = ponar sample collected after two zero-recovery vibracore runs
*The higher of the two values were utilized when a duplicate sample was collectec
**Sediment sample interval for nomenclature only, not indicative of actual sediment thickness
***SD-18 was the first location. After two separate failed attempts at retrieving vibracore cores that were advanced to refusal, it was determined to be an unsafe sampling approach. It was decided to advance the vibracore 2 to 3 feet, instead of refusal, to capture any soft sediment and sand layer, if presen
"<" used for Ponar recovery only (no vibracore recovery to confirm thickness)
J - indicates the analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sampl
Bolded total arsenic values indicates exceedance of the 20 mg/kg sediment criteria
mg/kg = milligrams per kilogram
USEPA = U.S. Environmental Protection Agency
Red text is EPA samples that were not collected from the sediment sample interval
ND = non detect
Green text is hold intervals that were run in fall 2018

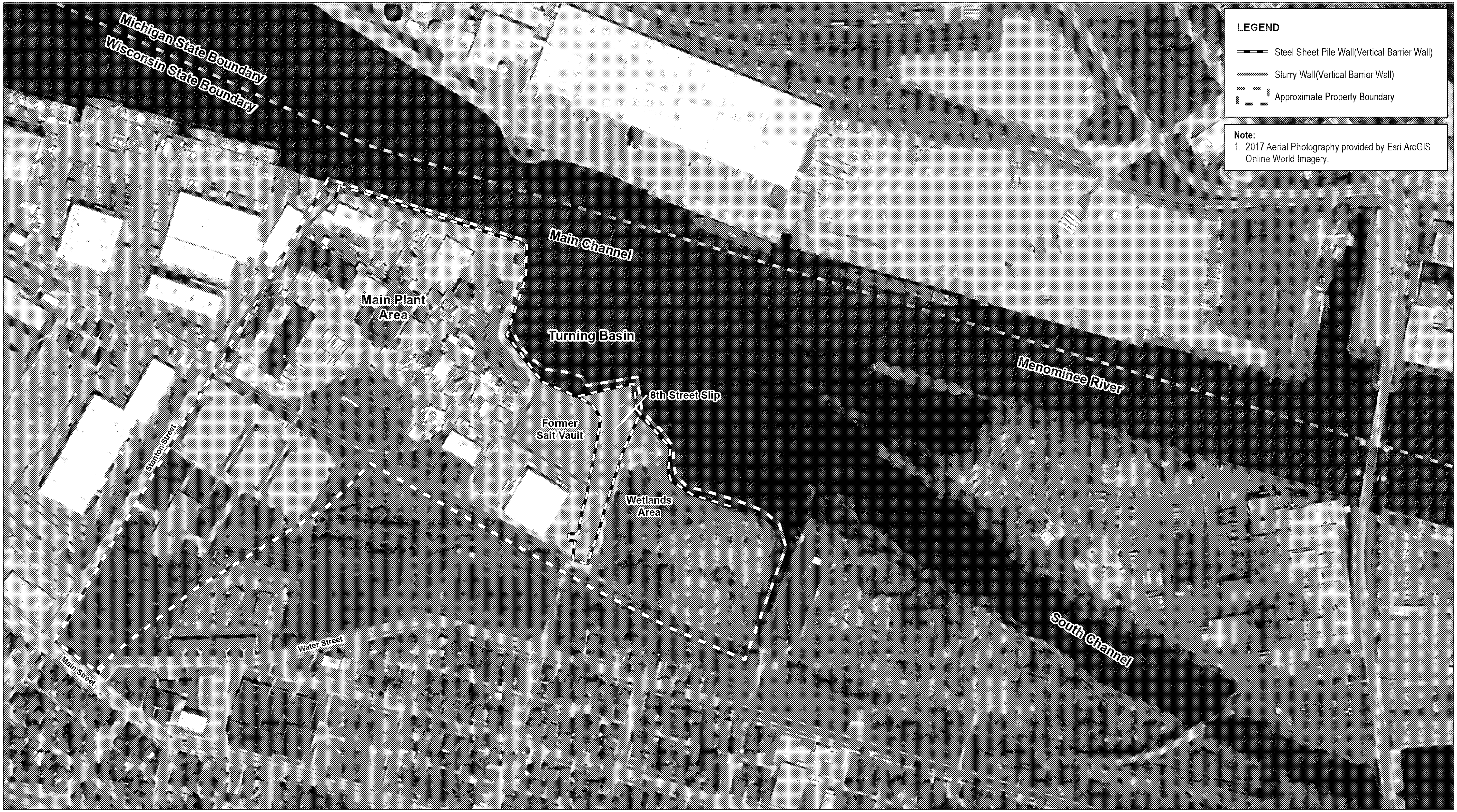
Table 16. Arsenic Treatment Technology Review Results
Tyco Fire Products LP Facility, Marinette, Wisconsin

Technology	Description	Potential Applicability to the Site
Hydraulic Fracturing "Fracking"	Use of high pressure fracturing to increase water permeation through the aquifer more efficiently to allow for groundwater extraction from low permeability soils	Not applicable. High pressure fracturing may preferentially channel due to the heterogeneous subsurface at the site and result in poor communication and reduced effectiveness or create unwanted connections between geologic layers. Could not complete in areas where permanent buildings, underground utilities and process lines exist, which will preclude work in close proximity to these areas. In the 2007 Earth Tech Corrective Measures Study (CMS), insitu stabilization was considered using high pressure injections. Similar issues were identified with this option.
Soil Treatment with Enhanced Coagulation Process	Excavation of high concentration areas throughout the site and using an enhanced coagulation process to stabilize and dispose of materials	Most of the higher contamination is in the medium depth wells and would be very difficult to perform excavation to treat those soils. May work for some localized shallower higher concentration areas, but would not be an overall remedy for the site. Would need a hazardous waste variance to treat the soils/groundwater onsite and limited area onsite for operations and excavation.
In Situ Solidification/ Stabilization	Pumping a slurried pozzolanic material (e.g. Portland cement/slag cement) that may include ferric based coagulants and quicklime to the subsurface in shallower high concentrations areas and solidify the soil to fixate arsenic and reduce permeability, sealing the migration pathways. Stabilization of soils down to a depth of 30 feet (top of glacial till) would necessitate the used of deep augers for mixing.	This approach would require bench and pilot scale testing to see if an effective mix design could be developed for the site soil/groundwater. Unlikely to be economical on a full scale level, but could be used to treat high concentration/source areas. Would not remove arsenic mass, only stabilize the material already onsite and reduce mobility of contaminants. The containment wall is already serving a similar purpose in containing the groundwater onsite. Other items to note: • Highly soluble and elevated arsenic concentrations as well brackish conditions pose a significant challenge for achieving permeability and leachability reductions. • Significant mass of pozzolanic materials and other arsenic fixation agents may be required which would result in a waste stream (water and soil) requiring offsite disposal. • The resulting swell may jeopardize the integrity of the existing containment structure (slurry and sheet pile walls). Tie back structures would also pose a significant challenge that may result in incomplete stabilization in these areas. • Would require complete demolition of paved surface and cover areas and construction debris present in the fill layers and SV concrete sub structure would likely need to be excavated/cleared prior to mixing. Could not be conducted in areas where buildings are located. • Uncertainty around the feasibility of finding an effective mix that can be applied across the entirety of the containment areas (including in the vicinity of tie back structures). • Potential for damage to the existing containment structures.
In Situ Chemical Fixation	Through injections of site-specific reagents, chemically alter the form of arsenic and promote the formation of mineral species to allow for the precipitation or adsorption of the arsenic onto aquifer solids.	This approach would require bench and pilot scale testing to determine appropriate geochemical mechanisms, reagents and dosing. Mobility of organic forms of arsenic present at the site represent a unique challenge for this technology; would require an oxidant followed by other precipitation in-situ. The high concentrations would also add to the challenge. Unlikely to be economical on a full scale level, but could be used to treat high concentration/source areas: however, would not remove arsenic mass, just reduce its mobility in groundwater. The containment wall is already serving a similar purpose in containing the groundwater onsite.
Permeable Reactive Barrier (PRB)	Walls containing reactive media that are installed across the path of a contaminated groundwater plume to intercept the plume. The barrier allows water to pass through while the media remove the contaminants by precipitation, degradation, adsorption, or ion exchange.	This approach would require bench and pilot scale testing to see if approach would work at the site. Mobility of organic forms of arsenic present at the site represent a unique challenge for this technology. In the CMS, PRB was considered and pilot tested. Issues were identified with this option if it were brought to full scale. In addition, a natural groundwater flow path no longer exists since the site is now contained and given concentrations and the literature the life span of media would be limited.
Improve Treatment Capability of Existing Groundwater Treatment System	Improve 5 stages of existing groundwater collection and treatment system (GWCTS) that include oxidation, coagulation, precipitation, filtration and RO extraction and add final stage with carbon bed and ion exchange process as polishing step. This would include larger state of the art equipment that incorporates redundancies that should result in less down time and greater operational flexibility (compared to existing GWCTS and pre-treatment options) and will achieve better overall water quality at discharge than pre-treatment options.	An improved system was proposed to allow for onsite treatment of the Pump Down Program (PDP) groundwater (PDP areas are required to be maintained below a target groundwater elevation) because the existing GWCTS was not able to treat the increased flows needed to maintain the target elevation. Evaluations are underway to size the system to treat the anticipated level of flow and utilize existing resources to meet overall treatment needs. The proposed system is using the best available technology for treating arsenic and will reach the lowest effluent concentrations of any other technologies. Wisconsin Pollutant Discharge and Elimination System (WPDES) effluent standards are currently being evaluated, however arsenic water quality standards are met with minimal mixing with river water and data suggests that adverse effects or unacceptable risk to human health, aquatic life, and wildlife is not occurring (see 2014 Variance Application). This technology is only as an upgrade/improvement to the current GWCTS. This technology would not change the site remedy, as pump and treat is not a viable option at the site due to limited groundwater extraction capabilities at the site.
High Efficiency Lamella	Install an inclined plate settler along with a coagulation addition to increase the efficiency of the groundwater collection and treatment system (GWCTS) and reduce the amount of waste in the reverse osmosis (RO) reject water	Only as an upgrade/improvement to the current GWCTS. This technology would not change the site remedy, as pump and treat is not a viable option at the site due to limited groundwater extraction capabilities at the site. However, the technology could be used to improve the current GWCTS ability to extract a higher ratio of highly contaminated water versus lower contaminated water and would also reduce operation and maintenance (O&M) cleaning frequencies for the micro filtration (MF) and RO systems. This technology was added to the GWCTS in 2016 and will be included as part of any future plant upgrades to increase the overall efficiency of the system and continue to treat the groundwater as it is currently operated to meet WPDES requirements.

Table 16. Arsenic Treatment Technology Review Results
Tyco Fire Products LP Facility, Marinette, Wisconsin

Technology	Description	Potential Applicability to the Site
Ion Exchange System with a Granular Activated Carbon (GAC) Bed	Use an ion exchange system with a GAC bed to concentrate the arsenic as opposed to treatment.	Only as an upgrade/improvement to the current GWCTS. Approach would have to be bench scale tested to see if it would work. This technology would not change the site remedy, as pump and treat is not a viable option at the site due to limited groundwater extraction capabilities at the site. However, the technology could be used to improve the current GWCTS ability to reduce the influent concentration for arsenic thus increasing the permeate volume while reducing the volume of hauled wastewater from the site. The current system does, however, treat the groundwater as it is currently operated to meet WPDES requirements and the technology is not necessary for meeting WPDES requirements. This technology is currently planned to be added to the GWCTS as part of any future plant upgrades
Biogeochemical Reactor using Zero Valent Iron (ZVI) or ZVI+Organic Carbon	Divert groundwater flows to a subgrade or above grade biogeochemical reactor containing ZVI or a mixture of ZVI and organic carbon that would be sized to provide sufficient hydraulic residence time given range of anticipated flow rates and treatment goal. Arsenic removal from water using ZVI is attributable to adsorption onto corrosion products of the ZVI, including iron hydroxides, oxyhydroxides, and mixed-valance iron Fe(II)-Fe(III) green rusts. In groundwater containing sulfate and a sufficient carbon source to promote sulfate reduction, arsenic can also be coprecipitated with metal sulfide minerals.	Was considered for managing the pump down program (PDP) water as a pre-treatment step. This technology would not change the site remedy, as pump and treat is not a viable option at the site due to limited groundwater extraction capabilities at the site. It was determined that the combination of organic arsenic at such elevated concentrations and anticipated flows of 2-3 gallons per minute, the reactor size and media changeout frequency would be impracticable. This technology was eliminated as part of the PDP work plan evaluation.
Oxidation	Reverse osmosis (included as part of existing GWCTS) does a better job of removing arsenate (As V) compared with arsenite (As III). Therefore, when present, As III should be oxidized to As V for efficient removal. Oxidation of As III to As V can be achieved readily by chlorine, permanganate, ozone and manganese-oxide-based solid media.	Although ozone has been a proven and efficient oxidant for arsenic, testing of the particular matrix and poor-quality groundwater at the site, as part of the sediment remediation project, has shown that sodium hypochlorite addition provides the best As II to As V conversion for site groundwater. Sodium hypochlorite has been added to the existing GWCTS, as needed, to help remove a persistent biofilm, and also aids in the oxidation process when utilized. This technology is planned to be included as part of any future plant upgrades.
Precipitation and Ultrafiltration Pre-treatment System	A chemical precipitation and ultrafiltration-based pretreatment system for PDP groundwater. Install new pretreatment system with two (2) 7,400 equalization tanks followed by three (3) stage chemical reaction process utilizing bleach, ferric sulfate, and caustic soda as treatment chemicals to precipitate arsenic and polymer to assist in settling prior to processing through an incline plate settling unit. Arsenic that is stabilized and bound in sludge to be removed via two (2) 40 cubic feet filter press systems. Supernatant processed water from inclined plate settler will be processed through two (2) parallel ultrafiltration (UF) systems to ensure water clarity prior to transfer to existing GWCTS system for polishing. System would include full suite of quality monitoring sensors as well as SCADA alarm system to notify operator of any system upsets.	Was considered for managing the pump down program (PDP) water as a pre-treatment step. This technology would not change the site remedy, as pump and treat is not a viable option at the site due to limited groundwater extraction capabilities at the site. The technology has shown to be viable in bench trials but is not as robust and complete in arsenic removal as the current GWCTS process or proposed similar upgrades. Although it would produce a non-hazardous waste, the decreased O&M operational efficiencies from having the pre-treatment system in a separate building, large amount of chemicals needed, and the lack of polishing enhancements also make the upgrades alternative a better choice. This technology was eliminated as part of the PDP focused alternatives evaluation.

Figures



N

0 400 800
Approximate scale in feet

Figure 1. Site Map
Tyco Fire Products LP Facility
Marinette, WI

\LAKEFRONT\PROJ\TYCO\MAPFILES\2018\FIVEYEARREVIEW\FIGURE 1 - SITE MAP.MXD, DATE SAVED: 12/18/2018 4:41:25 PM, USER NAME: JHANSEN1

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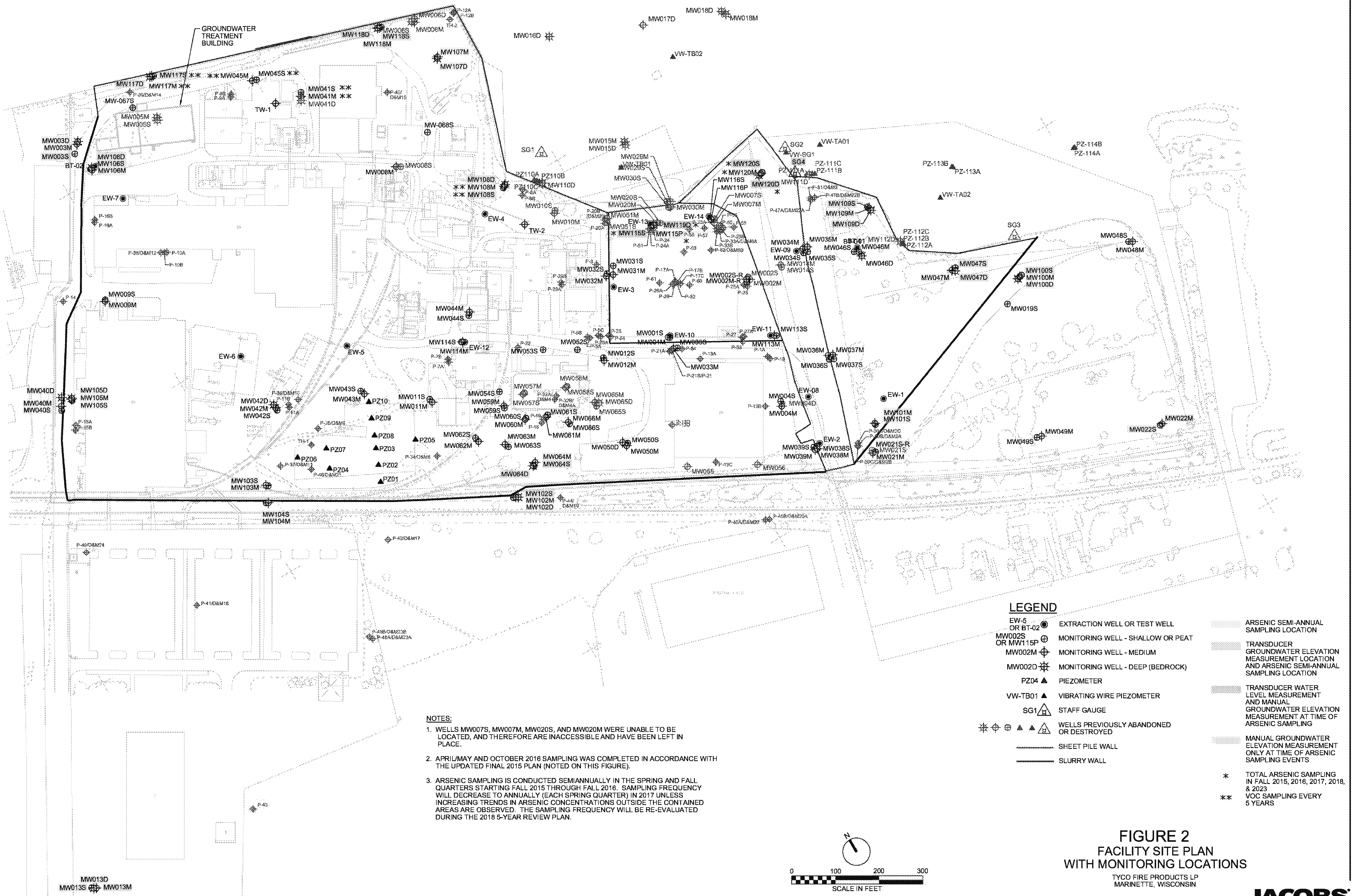

LEGEND

EW-5 OR BT-02	EXTRACTION WELL OR TEST WELL
MW002S OR MW115P	MONITORING WELL - SHALLOW OR PEAT
MW002M	MONITORING WELL - MEDIUM
MW002D	MONITORING WELL - DEEP (BEDROCK)
PZ04	PIEZOMETER
VW-TB01	VIBRATING WIRE PIEZOMETER
SG1	STAFF GAUGE
	WELLS PREVIOUSLY ABANDONED OR DESTROYED
	SHEET PILE WALL
	SLURRY WALL
	ARSENIC SEMI-ANNUAL SAMPLING LOCATION
	TRANSDUCER GROUNDWATER ELEVATION MEASUREMENT LOCATION AND ARSENIC SEMI-ANNUAL SAMPLING LOCATION
	TRANSDUCER WATER LEVEL MEASUREMENT AND MANUAL GROUNDWATER ELEVATION MEASUREMENT AT TIME OF ARSENIC SAMPLING
	MANUAL GROUNDWATER ELEVATION MEASUREMENT ONLY AT TIME OF ARSENIC SAMPLING EVENTS
*	TOTAL ARSENIC SAMPLING IN FALL 2015, 2016, 2017, 2018, & 2023
**	VOC SAMPLING EVERY 5 YEARS

NOTES:

1. WELLS MW007S, MW007M, MW020S, AND MW020M WERE UNABLE TO BE LOCATED, AND THEREFORE ARE INACCESSIBLE AND HAVE BEEN LEFT IN PLACE.
2. APRIL/MAY AND OCTOBER 2016 SAMPLING WAS COMPLETED IN ACCORDANCE WITH THE UPDATED FINAL 2015 PLAN (NOTED ON THIS FIGURE).
3. ARSENIC SAMPLING IS CONDUCTED SEMIANNUALLY IN THE SPRING AND FALL QUARTERS STARTING FALL 2015 THROUGH FALL 2016. SAMPLING FREQUENCY WILL DECREASE TO ANNUALLY (EACH SPRING QUARTER) IN 2017 UNLESS INCREASING TRENDS IN ARSENIC CONCENTRATIONS OUTSIDE THE CONTAINED AREAS ARE OBSERVED. THE SAMPLING FREQUENCY WILL BE RE-EVALUATED DURING THE 2018 5-YEAR REVIEW PLAN.

FIGURE 2
FACILITY SITE PLAN WITH MONITORING LOCATIONS

TYCO FIRE PRODUCTS LP
MARINETTE, WISCONSIN

JACOBS

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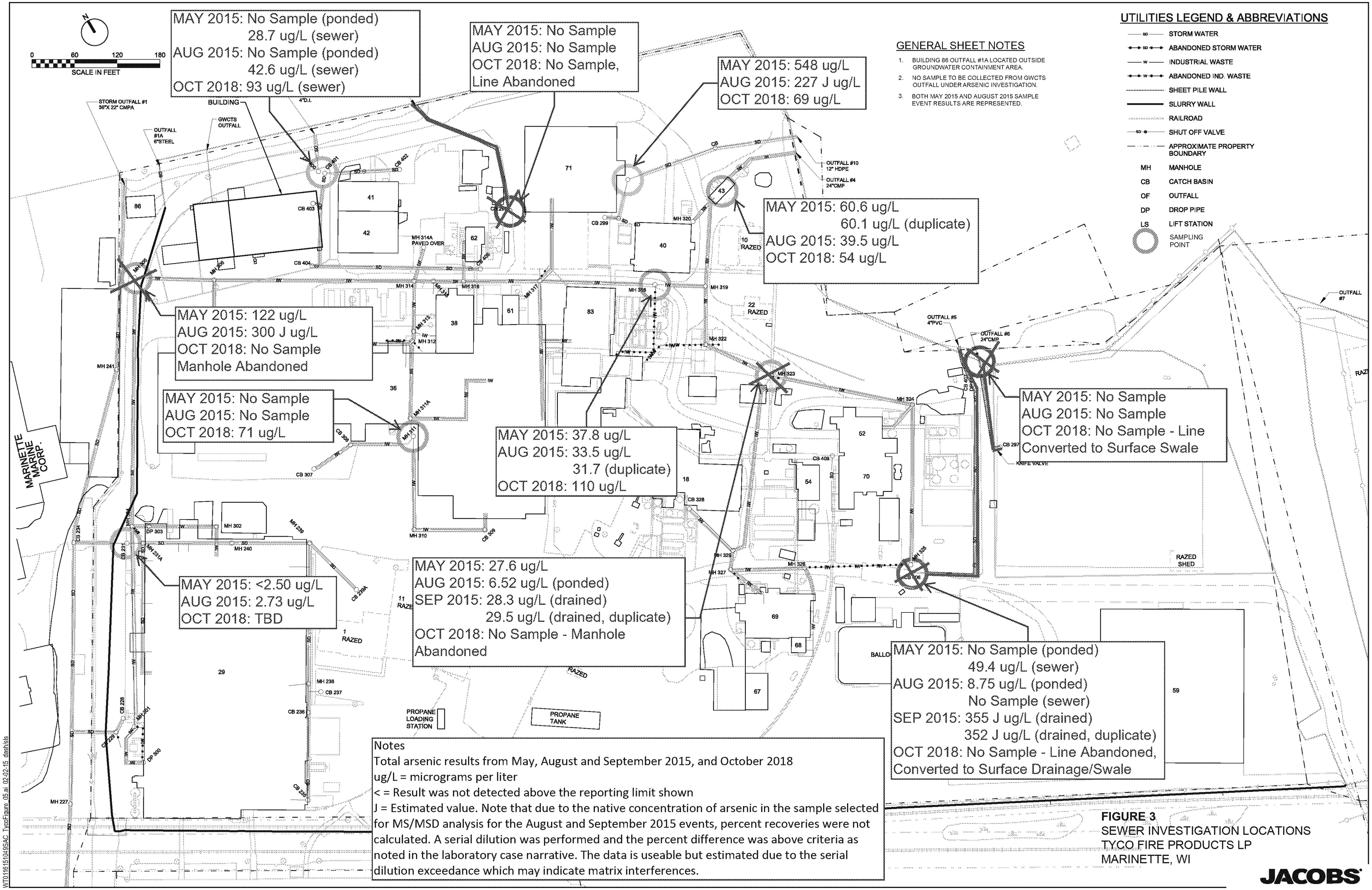

FIGURE 3
SEWER INVESTIGATION LOCATIONS
TYCO FIRE PRODUCTS LP
MARINETTE, WI

JACOBS

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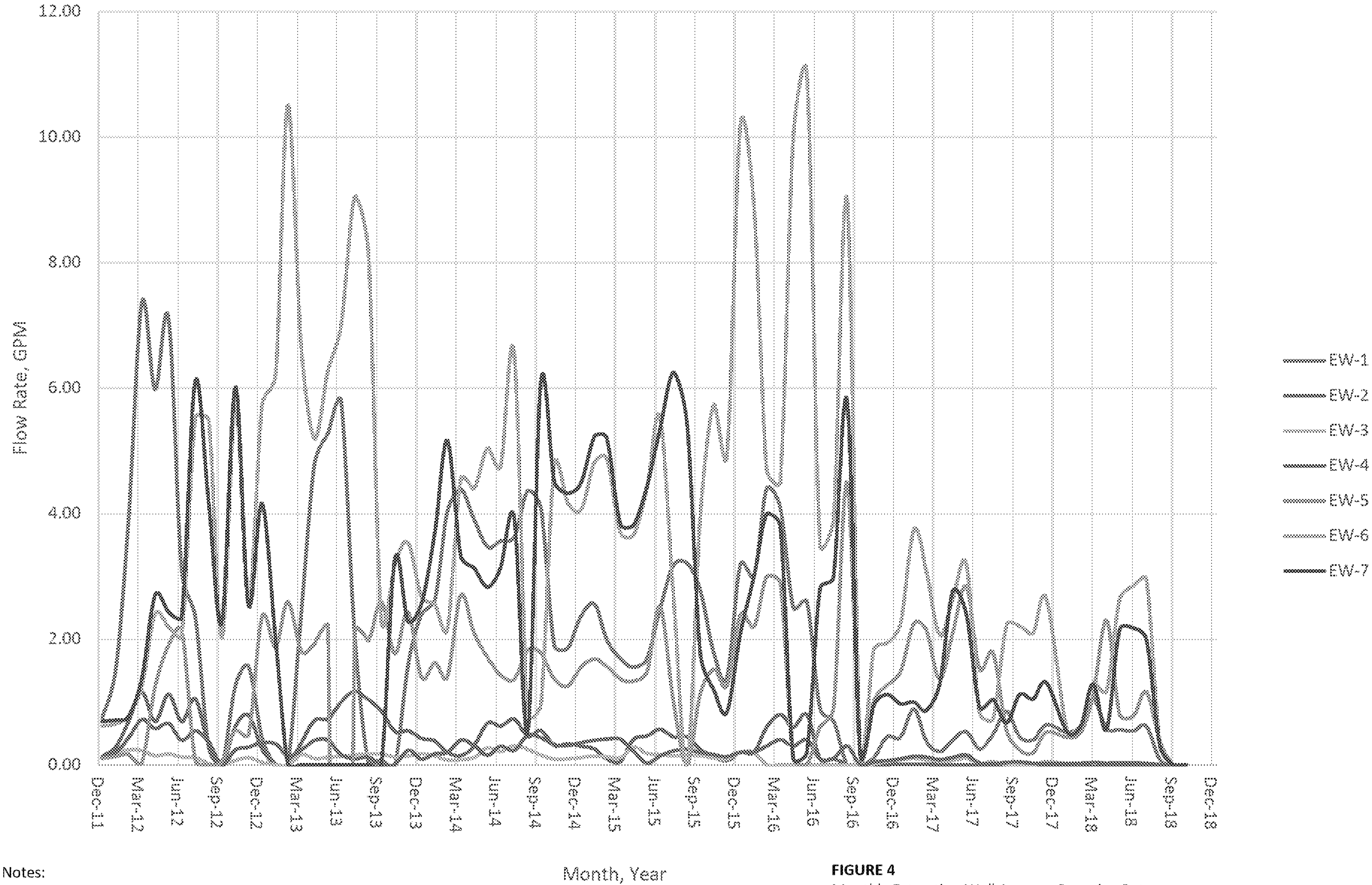
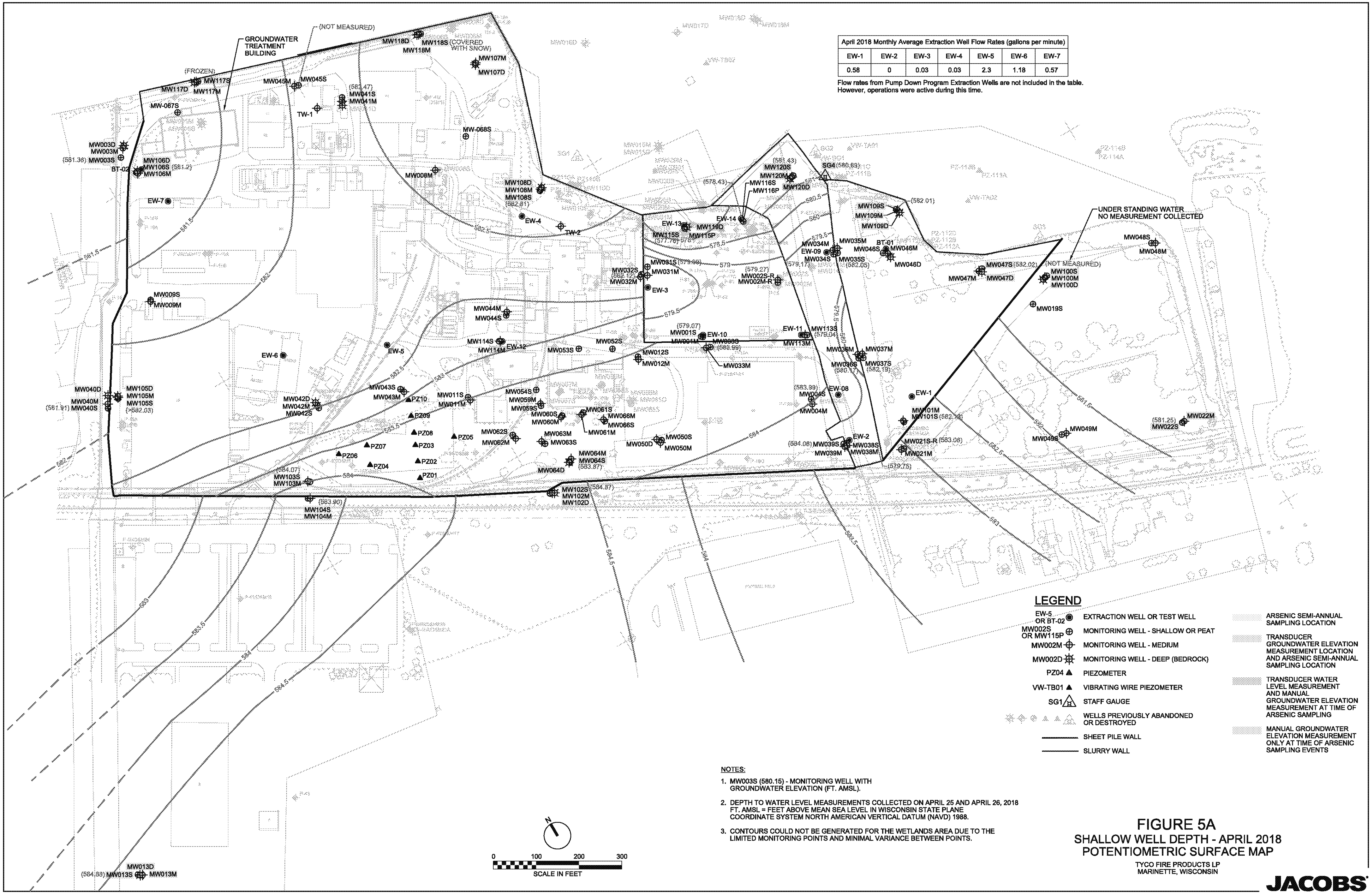


Notes:
GPM - Gallons per minute
EW - Extraction Well

FIGURE 4
Monthly Extraction Well Average Pumping Rates
Tyco Fire Products LP
Marinette, Wisconsin

April 2018 Monthly Average Extraction Well Flow Rates (gallons per minute)						
EW-1	EW-2	EW-3	EW-4	EW-5	EW-6	EW-7
0.58	0	0.03	0.03	2.3	1.18	0.57

Flow rates from Pump Down Program Extraction Wells are not included in the table. However, operations were active during this time.



LEGEND

EW-5 OR BT-02	EXTRACTION WELL OR TEST WELL
MW002S OR MW115P	MONITORING WELL - SHALLOW OR PEAT
MW002M	MONITORING WELL - MEDIUM
MW002D	MONITORING WELL - DEEP (BEDROCK)
PZ04	PIEZOMETER
VW-TB01	VIBRATING WIRE PIEZOMETER
SG1	STAFF GAUGE
	WELLS PREVIOUSLY ABANDONED OR DESTROYED
	SHEET PILE WALL
	SLURRY WALL
	ARSENIC SEMI-ANNUAL SAMPLING LOCATION
	TRANSDUCER GROUNDWATER ELEVATION MEASUREMENT LOCATION AND ARSENIC SEMI-ANNUAL SAMPLING LOCATION
	TRANSDUCER WATER LEVEL MEASUREMENT AND MANUAL GROUNDWATER ELEVATION MEASUREMENT AT TIME OF ARSENIC SAMPLING
	MANUAL GROUNDWATER ELEVATION MEASUREMENT ONLY AT TIME OF ARSENIC SAMPLING EVENTS

NOTES:

1. MW003S (580.15) - MONITORING WELL WITH GROUNDWATER ELEVATION (FT. AMSL).
2. DEPTH TO WATER LEVEL MEASUREMENTS COLLECTED ON APRIL 25 AND APRIL 26, 2018 FT. AMSL = FEET ABOVE MEAN SEA LEVEL IN WISCONSIN STATE PLANE COORDINATE SYSTEM NORTH AMERICAN VERTICAL DATUM (NAVD) 1988.
3. CONTOURS COULD NOT BE GENERATED FOR THE WETLANDS AREA DUE TO THE LIMITED MONITORING POINTS AND MINIMAL VARIANCE BETWEEN POINTS.

FIGURE 5A
SHALLOW WELL DEPTH - APRIL 2018 POTENTIOMETRIC SURFACE MAP

TYCO FIRE PRODUCTS LP
MARINETTE, WISCONSIN

JACOBS

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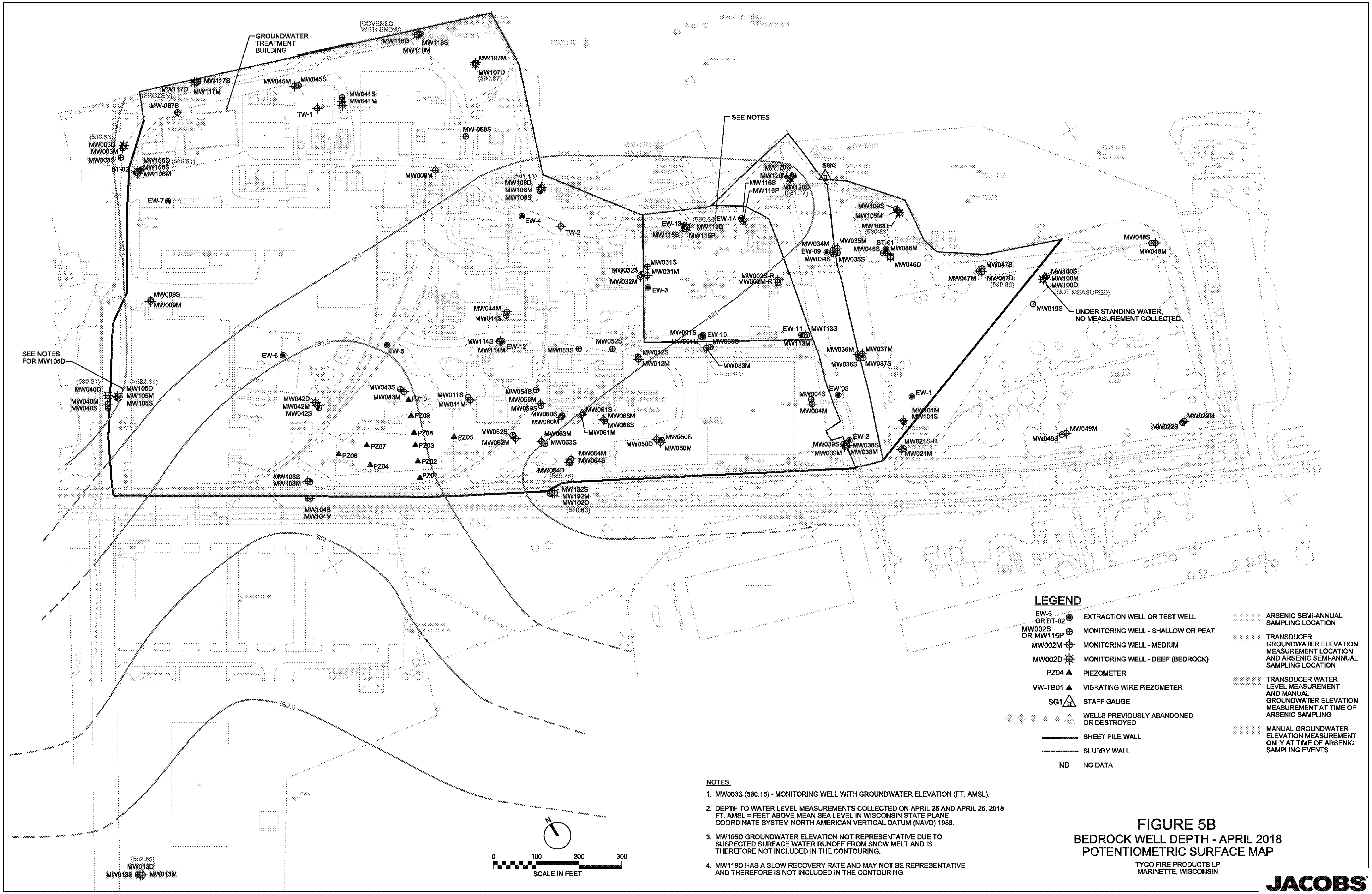

NOTES:

1. MW003S (580.15) - MONITORING WELL WITH GROUNDWATER ELEVATION (FT. AMSL).
2. DEPTH TO WATER LEVEL MEASUREMENTS COLLECTED ON APRIL 25 AND APRIL 26, 2018 FT. AMSL = FEET ABOVE MEAN SEA LEVEL IN WISCONSIN STATE PLANE COORDINATE SYSTEM NORTH AMERICAN VERTICAL DATUM (NAVD) 1988.
3. MW105D GROUNDWATER ELEVATION NOT REPRESENTATIVE DUE TO SUSPECTED SURFACE WATER RUNOFF FROM SNOW MELT AND IS THEREFORE NOT INCLUDED IN THE CONTOURING.
4. MW119D HAS A SLOW RECOVERY RATE AND MAY NOT BE REPRESENTATIVE AND THEREFORE IS NOT INCLUDED IN THE CONTOURING.

FIGURE 5B
BEDROCK WELL DEPTH - APRIL 2018
POTENTIOMETRIC SURFACE MAP

TYCO FIRE PRODUCTS LP
MARINETTE, WISCONSIN

JACOBS

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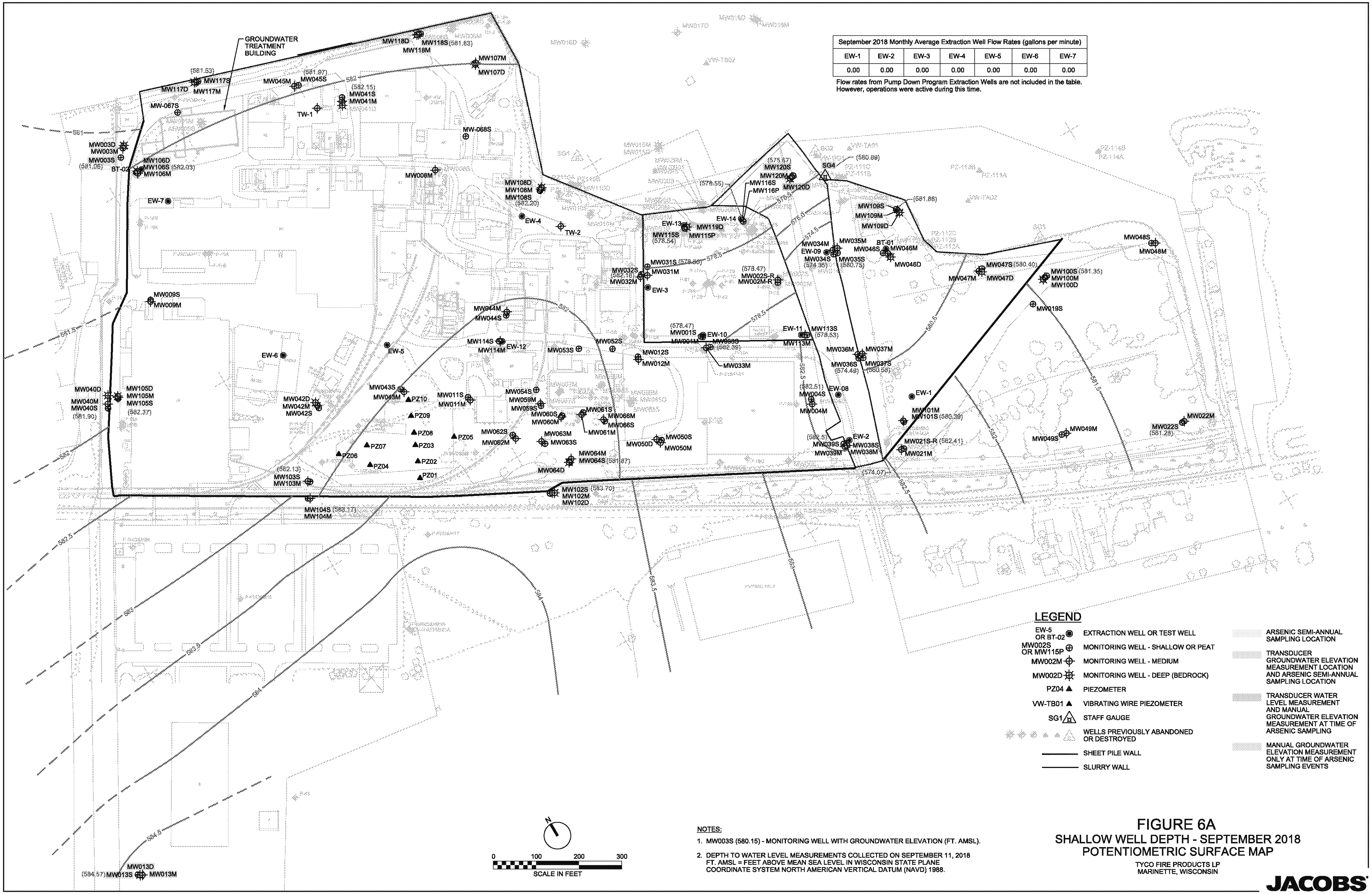

September 2018 Monthly Average Extraction Well Flow Rates (gallons per minute)						
EW-1	EW-2	EW-3	EW-4	EW-5	EW-6	EW-7
0.00	0.00	0.00	0.00	0.00	0.00	0.00

Flow rates from Pump Down Program Extraction Wells are not included in the table. However, operations were active during this time.

LEGEND

- EW-5 OR BT-02 — EXTRACTION WELL OR TEST WELL
- MW002S OR MW115P — MONITORING WELL - SHALLOW OR PEAT
- MW002M — MONITORING WELL - MEDIUM
- MW002D — MONITORING WELL - DEEP (BEDROCK)
- PZ04 — PIEZOMETER
- VW-TB01 — VIBRATING WIRE PIEZOMETER
- SG1 — STAFF GAUGE
- WELLS PREVIOUSLY ABANDONED OR DESTROYED
- SHEET PILE WALL
- SLURRY WALL
- ARSENIC SEMI-ANNUAL SAMPLING LOCATION
- TRANSDUCER GROUNDWATER ELEVATION MEASUREMENT LOCATION AND ARSENIC SEMI-ANNUAL SAMPLING LOCATION
- TRANSDUCER WATER LEVEL MEASUREMENT AND MANUAL GROUNDWATER ELEVATION MEASUREMENT AT TIME OF ARSENIC SAMPLING
- MANUAL GROUNDWATER ELEVATION MEASUREMENT ONLY AT TIME OF ARSENIC SAMPLING EVENTS

NOTES:

1. MW003S (580.15) - MONITORING WELL WITH GROUNDWATER ELEVATION (FT. AMSL).
2. DEPTH TO WATER LEVEL MEASUREMENTS COLLECTED ON SEPTEMBER 11, 2018 FT. AMSL = FEET ABOVE MEAN SEA LEVEL IN WISCONSIN STATE PLANE COORDINATE SYSTEM NORTH AMERICAN VERTICAL DATUM (NAVD) 1988.

FIGURE 6A
SHALLOW WELL DEPTH - SEPTEMBER 2018 POTENTIOMETRIC SURFACE MAP

TYCO FIRE PRODUCTS LP
MARINETTE, WISCONSIN

JACOBS

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